User Manual

Allen-Bradley

PowerMonitor 500 Unit

Catalog Numbers 1420

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

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This manual contains new and updated information. Changes throughout this revision are marked by change bars, as shown to the right of this paragraph.

New and Updated Information

This table contains the changes made to this revision.

Topic	Page
Added references to the EtherNet/IP network throughout the publication	Throughout
Updated the functional description of the Program/select button	11
Added a wiring diagram for the optional Ethernet network communication	21
Added information about configuring the unit by using the display	23
Added Ethernet port settings to the configuration flowchart	28
Added a section about Ethernet network communication	35
Studio 5000™ Logix Designer application is the rebranding of RSLogix™ 5000 software	36
Added an appendix for data tables	45
Added an appendix for the PowerMonitor™ 500 EtherNet/IP Device Profile	73

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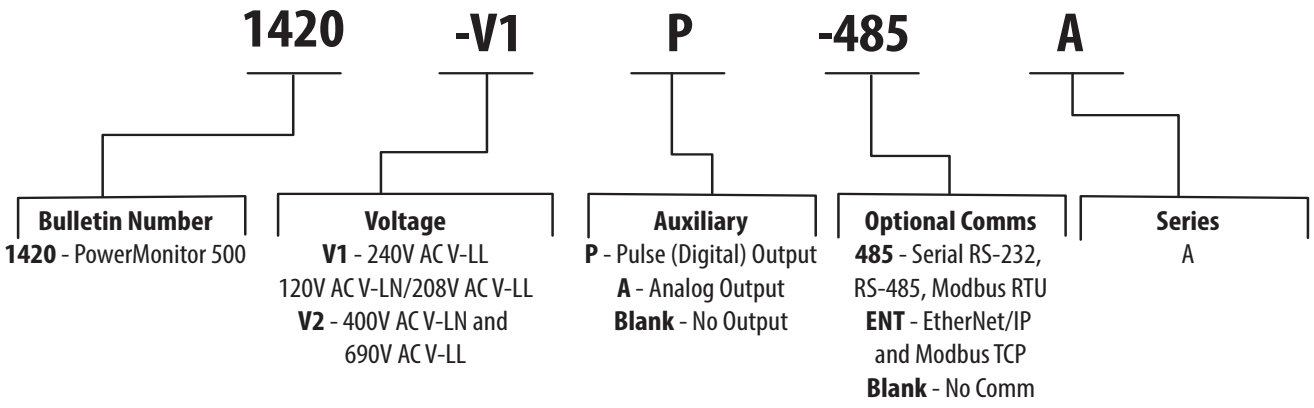
Catalog Number Explanation



Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation® industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http:/www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Notes:

PowerMonitor 500 Overview

About the PowerMonitor 500 Unit

The PowerMonitor 500 unit is an AC power monitor with a built-in advanced configuration system and LCD data display. The unit is designed for measurement of electrical parameters in a variety of three-phase and single-phase circuits. The unit is enclosed in a modular housing for panel mounting, with IP65 degree of protection in front of the panel. The power monitor can be provided with analog or digital outputs. These outputs can be selected to output a pulse proportional to the real and reactive energy measured, or to annunciate alarms. The instrument can also be equipped with a serial RS-485/RS-232 port, or an EtherNet/IP port, and analog outputs.

Equipped with an optional communication port, the unit communicates power and energy parameters to applications, such as FactoryTalk® EnergyMetrix™ software. The power monitor works with these software applications to address these key customer applications:

- Load profiling - log power parameters such as real energy, apparent power, and demand, for analysis of power usage by loads over time
- Cost allocation - reporting actual energy cost by department or process to integrate energy information into management decisions
- Billing and sub-billing - charging users of energy the actual usage cost rather than allocating by square footage or other arbitrary methods
- Power system monitoring and control - display and control power flow and energy utilization

PowerMonitor 500 Features and Functions

The power monitor connects to the user's three-phase or single-phase AC power system directly or through instrument transformers (PTs and CTs). It converts instantaneous voltage and current values to digital values, and uses the resulting digital values in calculations of voltage, current, power, energy, and demand.

The power monitor family includes several models that combine the following basic components:

- A panel-mounted power monitor in one of two AC voltage ranges: 240 (208Y/120V) or 690Y/400V
- An optional pair of relay outputs
- An optional pair of 0...20 mA analog outputs
- Optional serial RS-232/RS-485 communication supporting Modbus RTU
- Optional Ethernet port supporting EtherNet/IP and Modbus TCP
- Front protection degree: IP65, NEMA 4X, NEMA 12

- Up to four configurable virtual alarms
- Class 1 (kWh) according to EN62053-22
- Class B (kWh) according to EN50470-3
- Class 2 (kVARh) according to EN62053-23
- Accuracy ±0.5% of reading (current/voltage)
- Metering values display: 4 lines x 4 digit
- Energy value display: 10 digit plus sign
- Three-phase (system) variables: V(L-L), V(L-N), A, VA, W, VAR, power factor, frequency, unbalance.
- Single phase variables: V(L-L), V(L-N), A(L), An (calculated), VA, W, VAR, power factor
- System and single phase average and maximum variables
- Energy measurements (imported/exported): kWh and kVARh
- Revenue grade energy measurements per ANSI C12.20 Class 0.5, ANSI C12.1
- Run hours counter (8+2 digit)
- Real time clock function
- Universal power supply: 90...260V AC/DC
- Front dimensions: 96x96 mm

Front Panel Features

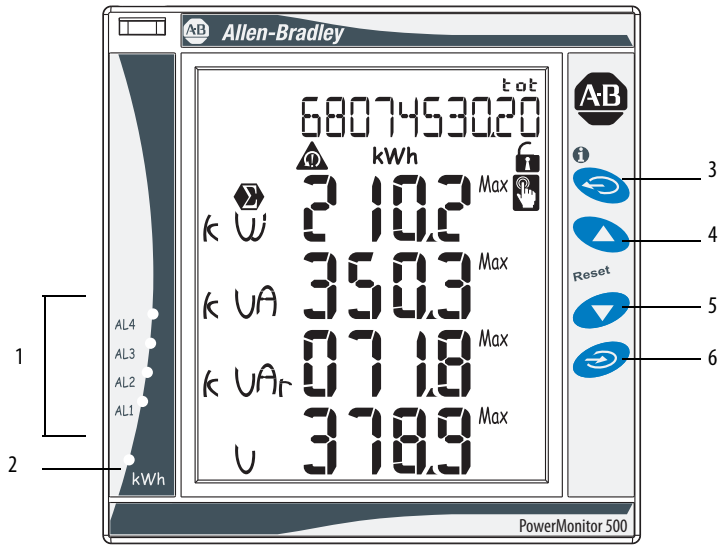
This section describes the front panel of the unit.

Front Panel Indicators and Control Buttons

The buttons are enhanced touch buttons. The touch icon turns on each time a button is pressed. We recommend using your forefinger to activate the touch buttons.

In Metering mode, buttons 4 and 5 are used to display the maximum and demand (average) values of the displayed measurements

Figure 1 - Front Panel



1. Active Alarms AL1...AL4 status indicators.
2. Real Energy consumption rate status indicator. Faster flashing indicates higher rate of consumption. Maximum frequency 16 Hz per EN5047-1.
3. Exit Button - Press quickly to exit submenus, or to exit the programming menus in Programming mode.

   When in the programming menu, press and hold the Exit button for at least 2 seconds to exit the programming menu. Press Program/select to confirm and return to the metering display.

   Press and hold for more than 2 seconds to view the information pages. In Metering mode, press quickly to scroll through the energy counters.
4. Up Button - Press the Up button to browse menus and to increase values to be set.
5. Down Button - Press the Down button to browse menus and to decrease values to be set.
6. Program/select Button - Press and hold the Program/select button for at least 2 seconds to access the programming menu.

   When in the programming menu, press the Program/select button to confirm the programmed values in the active page.

   When not in the programming menu, press the Program/select button to select measured values for display. Press quickly to scroll through the metering display pages.

   See Table 1 for a list of the measurement screens.

Additional Button Functions

Certain buttons have two functions. To access the second function, press and hold the button for more than 2 seconds.

Displays PowerMonitor 500 information screens, which provide reference standards, firmware revision, and year of manufacture.

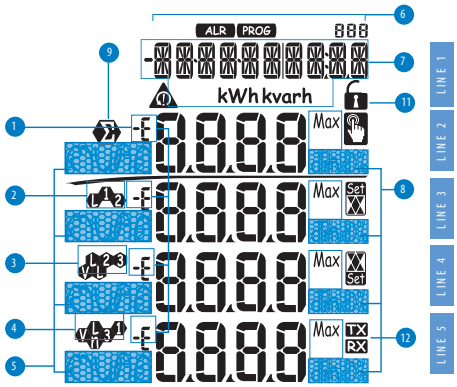
Resets the MAX (maximum) of the displayed variables.

Reset

Resets the dmd (demand) of the displayed variables.

To perform a reset, press this button to confirm.

Display Features



Display Indications

1. Phase displacement indicator: inductive L, -L, or capacitive C, -C.

   The sign is based on the direction of real power flow. Positive = consuming power, negative = generating power.
2. Indicates the measured value phase (phase-neutral L1 or phase-phase L12).
3. Indicates the measured value phase (phase-neutral L2, phase-phase L23, or unbalance phase-phase VLL).
4. Indicates the measured value phase (phase-neutral L3, phase-phase L31, or unbalance phase-neutral VLn).
5. Engineering unit and multiplier indicator (k, M, V, W, A, var, PF, Hz, An).
6. ALR: the alarm display function is active. PROG: the programming function is active.
7. Area set aside for energy counters (see table on the following screen), text messages, date and time (format: dd.mm.yy/hh:mm).
8. Indicates metering values are dmd (demand) or MAX (maximum) values.

Display Icons

9. Indicates that the metering values displayed are system (three-phase) values.
10. Indicates a phase sequence error alarm.
11. Configuration lock switch is not active. Always indicates unlocked.
12. Indication of serial RS-485/RS-232 data transmission (TX) and reception (RX).

Alarm Icons

- Indicates a high value alarm
- Indicates a low value alarm

Selecting Data to Display

The table below provides a guide to navigation through the metering data displays available on the front panel display.

Table 1 - Navigation

	No.		Line 1	Line 2	Line 3	Line 4	Line 5	Note
	Press the key for <2 seconds	0	Home page	Programmable				
		1	Total kWh (+)	Depending on the last displayed page of instantaneous variables.				
		2	Total kVARh (+)					
		3	kWh (+) part.					
		4	kVARh (+) part.					
		5	Run Hours (99999999.99)					
	Press the key for <2 seconds	6	Phase seq.	VLN Σ	VL1	VL2	VL3	
		7	Phase seq.	VLN Σ	VL1-2	VL2-3	VL3-1	
		8	Phase seq.	An	AL1	AL2	AL3	
		9	Phase seq.	Hz	-	-	-	
		10	Phase seq.	VA Σ	VA L1	VA L2	VA L3	
		11	Phase seq.	var Σ	var L1	var L2	var L3	
		12	Phase seq.	W Σ	WL1	WL2	WL3	
		13	Phase seq.	PF Σ	PF L1	PF L2	PF L3	

To access information pages, press and hold for more than 2 seconds, then press and to select information items, as shown in Table 2. Information items are not displayed for options that are not installed.

Table 2 - Information Items

	No.	Line 1	Line 2	Line 3	Line 4	Line 5
	1	Lot n. xxxx	Yr. xx	rEL	A.01	1…60 (min) 'dmd'
	2	Conn. xxx.x (3ph.n/3ph/ 3ph./ 3ph.2/1ph/2ph)	CT.rA	1.0…99.99k	Pt.rA	1.0…9999
	3	LED PULSE kWh	0.001…1000 kWh per pulse			
	4	PULSE OUT1 kWh/kVARh(1)	0.001…1000 kWh/kVARh per pulse	+/- tot/PAr		
	5	PULSE OUT2 kWh/kVARh(1)	xxxx kWh/kVARh per pulse	+/- tot/PAr		
	6	Remote out	out1	on/oFF	Out2	on/oFF
	7	AL1	variable	Set 1	Set 2	(measurement)
	8	AL2	variable	Set 1	Set 2	(measurement)
	9	AL3	variable	Set 1	Set 2	(measurement)
	10	AL4	variable	Set 1	Set 2	(measurement)
	11	ANALOG 1(1)	Hi.E	0.0…9999k	Hi.A	0.0…100.0%
	12	ANALOG 2(1)	Hi.E	0.0…9999k	Hi.A	0.0…100.0%
	13	COM port(1)	Add XXX	1…247	bdr	9.6/19.2/ 38.4/115.2
	14	IP ADDRESS	XXX	XXX	XXX	XXX
	15	XX•XX•XX XX:XX	dAtE	tiME		

(1) If appropriate option is selected.

Installation and Wiring

Installation

This section shows the dimensions of the unit for installation in a panel.

Figure 2 - Base Unit Dimensions

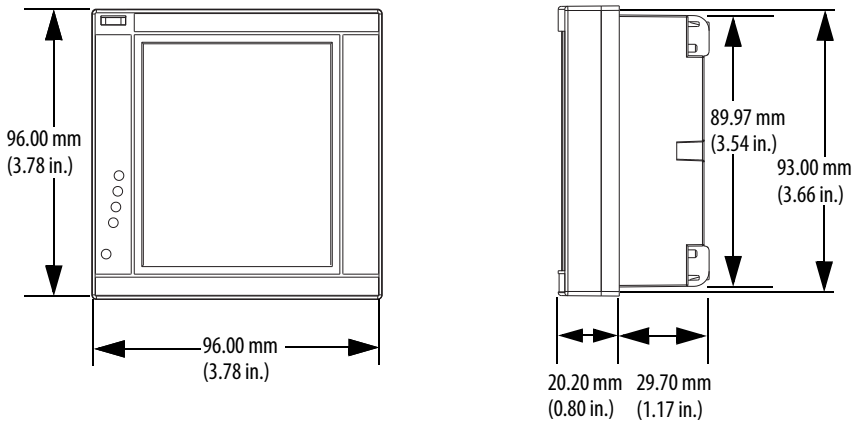


Figure 3 - Panel Cut-out

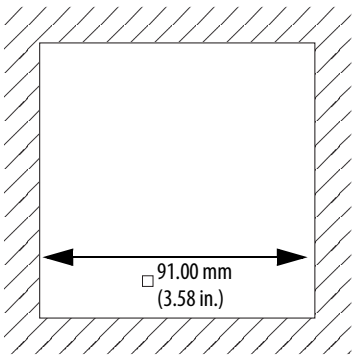


Figure 4 - Factory-installed Optional Modules

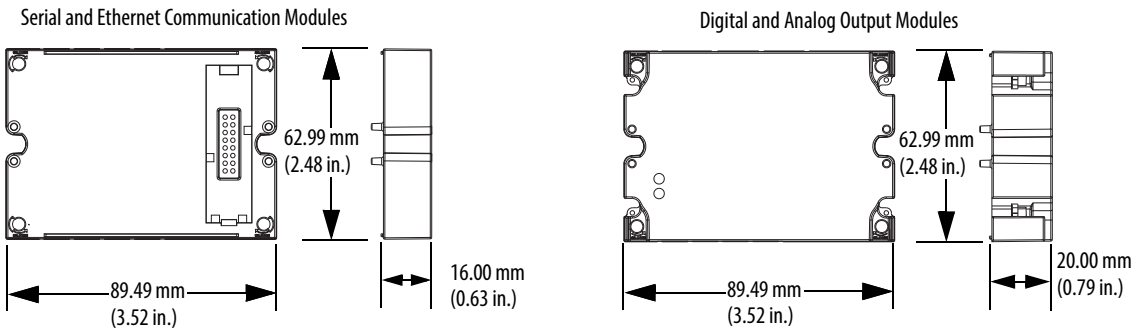


Figure 5 - Installation in Panel

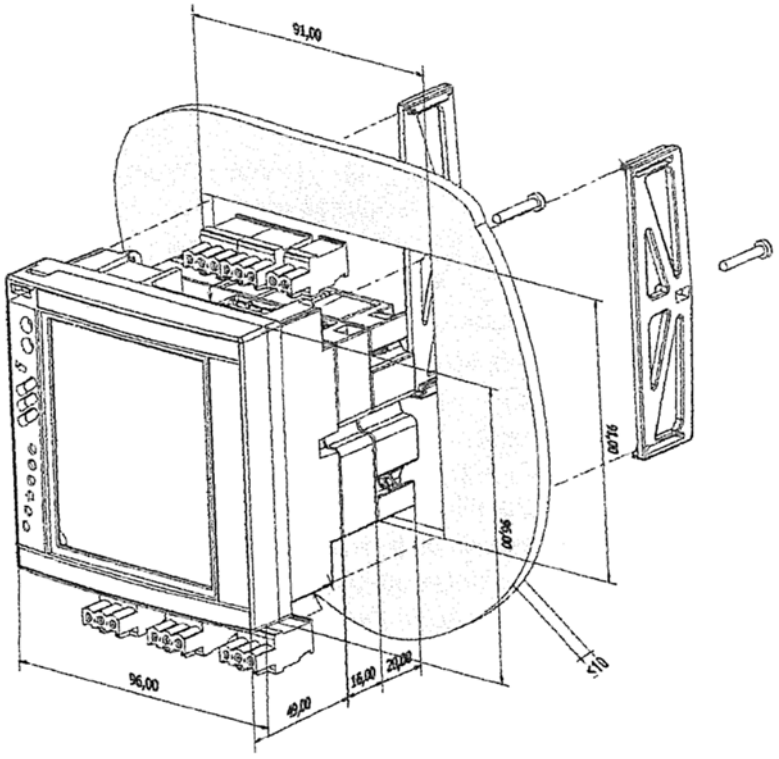
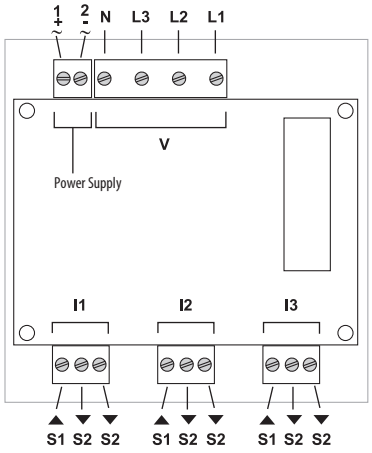


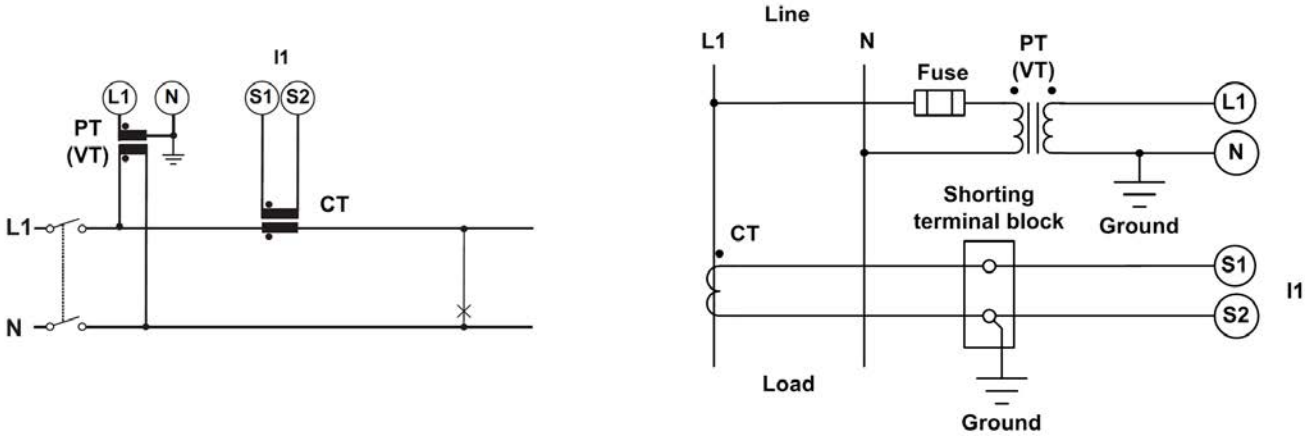
Figure 6 - Rear View of Unit Showing Wiring Terminals



Wiring Diagrams

The wiring diagrams in this manual are drawn with European (IEC) conventions. For convenience, a connection diagram is shown below in IEC style on the left and in its corresponding NEMA style (used in the U.S.) on the right.

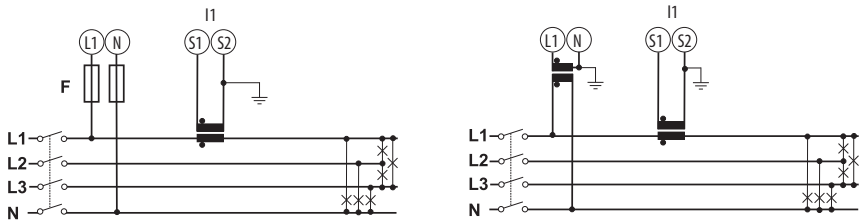
Figure 7 - Wiring Diagram Interpretation



These diagrams are simplified. Wiring of the power monitor must comply with all applicable codes, standards, and regulations. Voltage and control power wiring must be protected by suitable overcurrent protection. Connect current transformer (CT) secondary wiring through a suitable shorting terminal block.

IMPORTANT In these diagrams, 'balanced load' configurations permit 3-phase measurement by using only one phase connection. Unbalance in the measured circuit impacts the accuracy of the measurements.

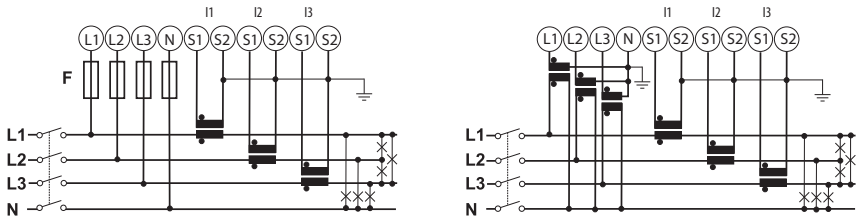
Figure 8 - System Type Selection: 3-phase.2, 3-phase, 2-wire, Balanced Load



1-CT Connection

1-CT and 1-VT/PT Connections

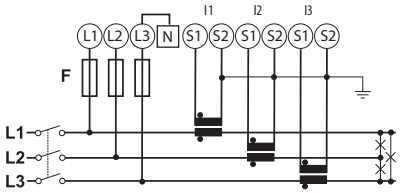
Figure 9 - System Type Selection: 3-phase.n, 3-phase, 4-wire, Unbalanced Load



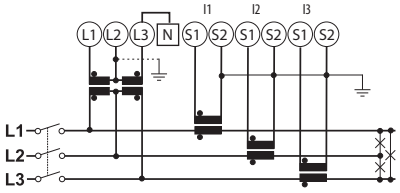
3-CT Connection

3-CT and 3-VT/PT Connections

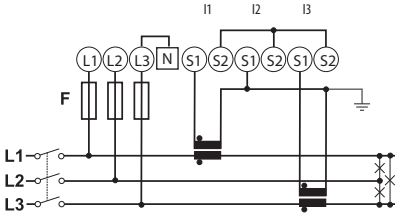
Figure 10 - System Type Selection: 3-Ph, 3-phase, 3-wire, Unbalanced Load



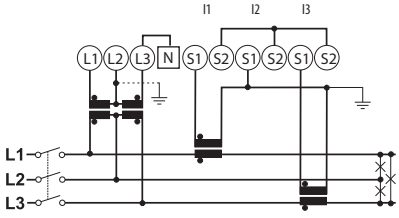
3-CT Connection



3-CT and 2-VT/PT Connections

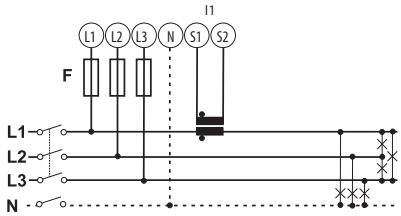


2-CT Connections (ARON)

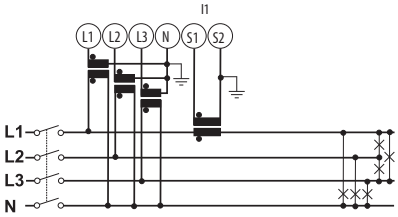


2-CT and 2-VT/PT Connections ARON

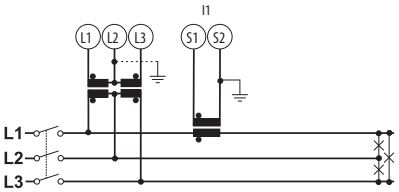
Figure 11 - System Type Selection: 3-Ph.1, 3-phase, 3-wire, Balanced Load



1-CT Connections

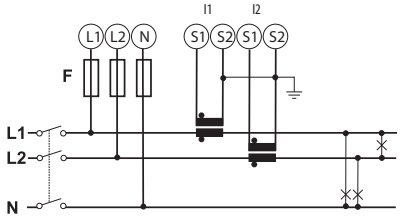


1-CT and 3-VT/PT Connections

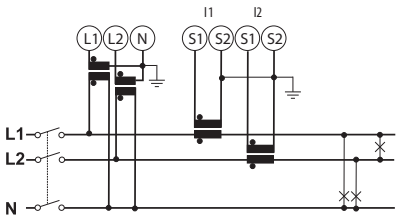


1-CT and 2-VT/PT Connections

Figure 12 - System Type Selection: 2-Ph, 2-phase (split-phase), 3-wire

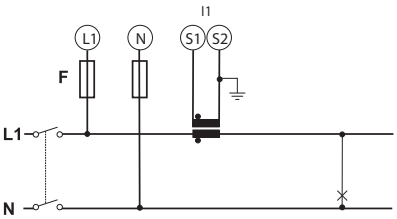


2-CT Connection

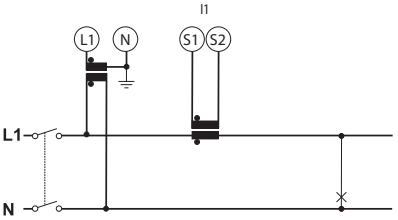


2-CT and 2-VT/PT Connections

Figure 13 - System Type Selection: 1-Ph, 1-phase, 2-wire



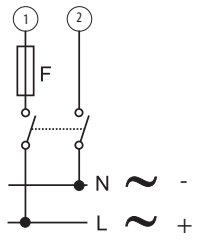
1-CT Connection



1-CT and 1-VT/PT Connections

Figure 14 - Supply Power

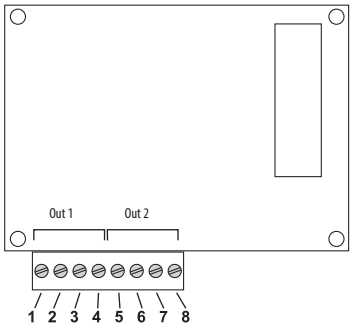
90…260V AC/DC



F = 250V (T) 630 mA

Factory Installed Option Wiring

Figure 15 - Pulse (digital) Outputs (P option)



Opto-mosfet

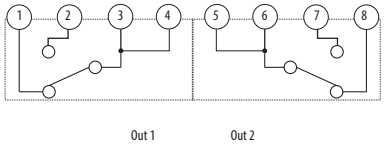
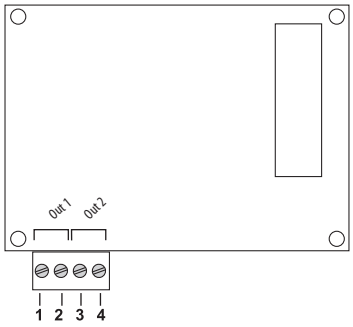
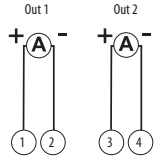


Figure 16 - Analog Outputs (A option)



Analog 20 mA DC



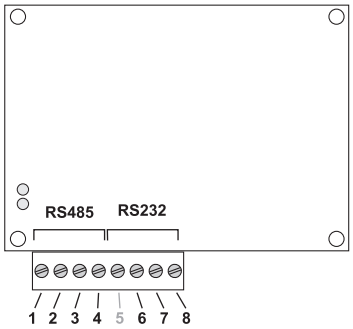
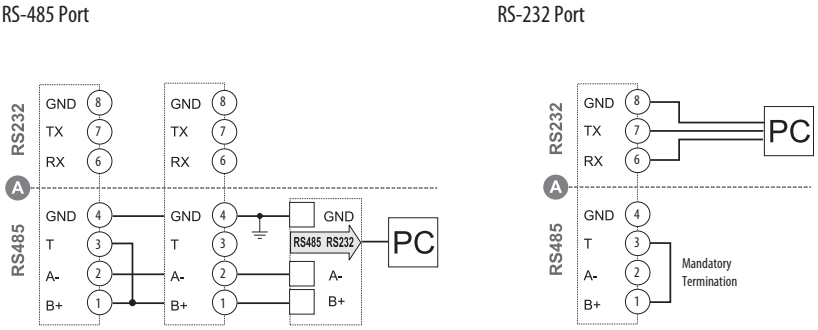
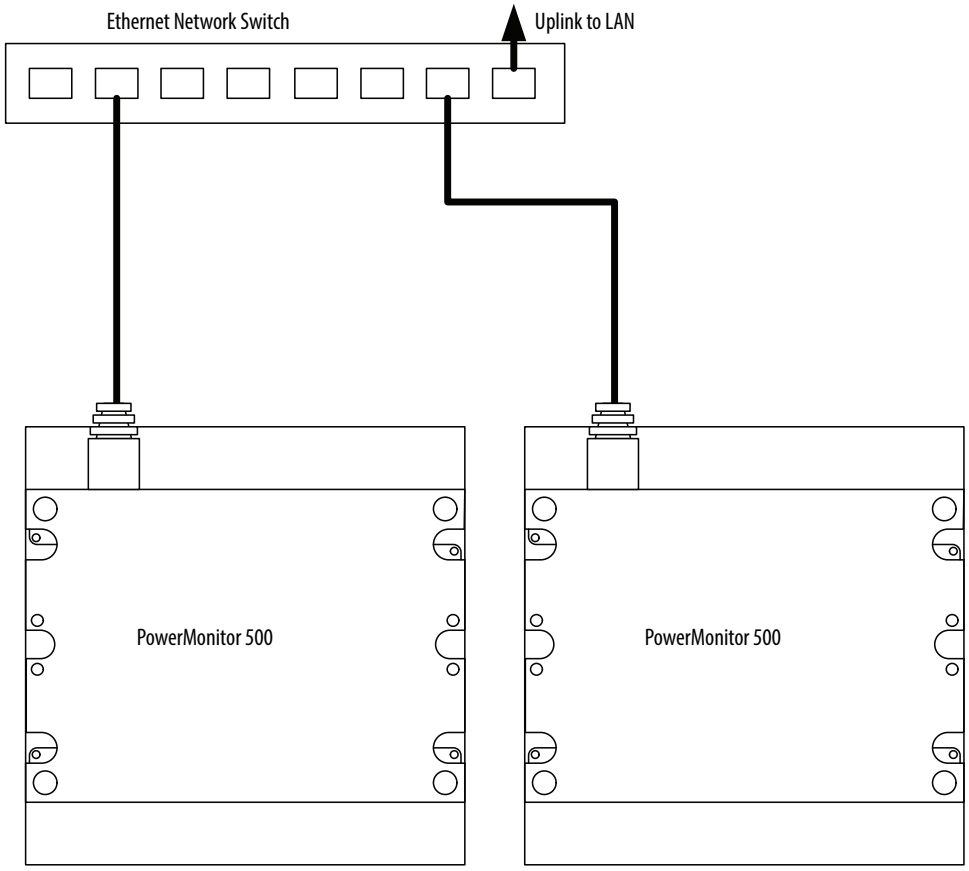


Figure 17 - Serial RS-485 and RS-232 Communication Wiring (485 option)



IMPORTANT Additional devices provided with RS-485 are connected in parallel. The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (B+) and (T). The RS-232 and RS-485 communication ports cannot be connected and used simultaneously.

Figure 18 - Optional Ethernet Communication (ENT option)



The PowerMonitor 500 unit connects to industry-standard Ethernet hubs and switches by using standard CAT-5 UTP (unshielded twisted-pair) cables with RJ45 connectors. Table 3 shows the cable and connector pin assignments.

Table 3 - Ethernet Network Connections

Terminal	Signal
1	TX+
2	TX-
3	RX+
4	
5	
6	RX-
7	
8	

Notes:

Unit Configuration

Configure with the Display

The PowerMonitor 500 unit provides menu-based configuration (programming) by using its front panel display. The programming menus let you select parameters to edit, select digits within parameters, and increase or decrease the value of each digit.

Place the unit in Programming mode by pressing Program/select (8) for about 2 seconds. The front panel displays the PASSWORD? menu page 0 in Editing mode. Enter the correct password by using the Up and Down arrows (the default password is 0) and press Program/select. The front panel then displays the CHANGE PAS menu page 10.

Refer to the programming flow chart beginning on page 26 for a view of the organization of programming menus and sub-menus. Each page is identified with a number. Menu page numbers end in zero, while sub-menu pages end in 1 through 9. For example, the Change Password page is menu 10. Likewise, the Dmd page is menu 80, and the demand interval Time page is menu 82.

While you are programming the power monitor, the display items and control buttons function one way when you are navigating between menu or sub-menu pages, and another way when you are editing a menu page.

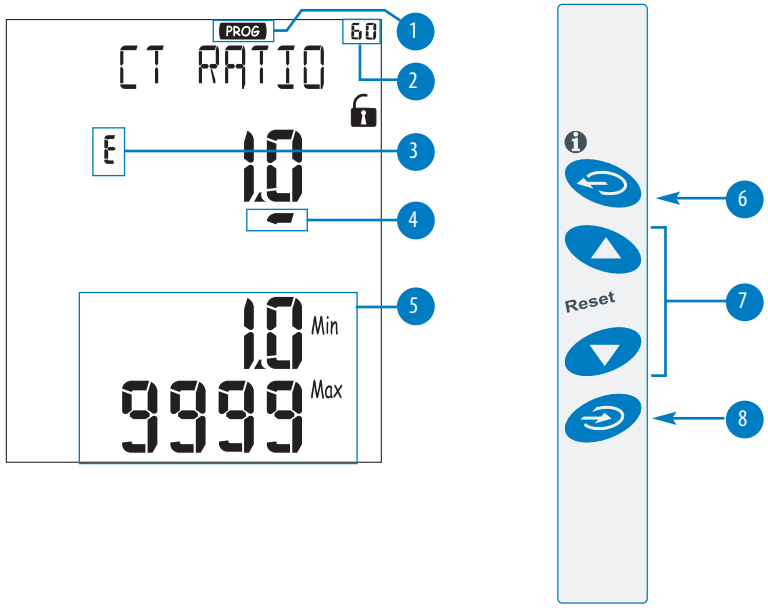


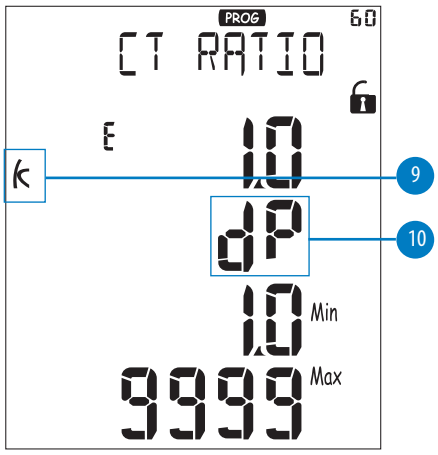
Table 4 - Front Panel Display Descriptions

Display Item	Description	Navigating Menus	Editing a Menu
1	Programming mode indicator	Indicates programming mode.	
2	Programming menu page	Identifies the current programming menu page. Refer to the programming flow chart beginning on page 26.	
3	Editing mode indicator	Does not appear.	Indicates the parameter being edited.
4	Cursor	Does not appear.	Appears beneath the digit currently being edited.
5	Permitted range	Displays the permitted range of values for the selected parameter.	
6	Exit button	• When in a menu page, exits Programming mode. Program/select button confirms exit. • When in a sub-menu page, exits to menu page.	• Moves the cursor one digit to the left. • When the leftmost digit is selected, dP is indicated and you can change the decimal point and multiplier (see Editing Decimal Point and Multiplier on page 25). • When held for at least 2 seconds, cancels the edit and restores the previous value of the selected parameter.
7	Up button	Selects the next higher-numbered menu or sub-menu page.	• Increments the value of the digit indicated by the cursor. • When dP is indicated, increments the decimal point and multiplier .
	Down button	Selects the next lower-numbered menu of sub-menu page.	• Decrements the value of the digit indicated by the cursor. • When dP is indicated, decrements the decimal point and multiplier .
8	Program/select button	• Selects a menu page for editing. • When in a menu page with sub-menus, displays the first sub-menu page. • After pressing the Exit button, confirms exit from Programming mode. • From End menu page 260, saves new configuration and exits Programming mode.	Stores the new value of the selected parameter, but does not save the new configuration to the power monitor.

IMPORTANT To save programming changes, navigate to the End menu page 260 and press Program/select. To exit the Programming mode without saving any changes, press Exit and confirm by pressing Program/select. If no buttons have been pressed for two minutes, the power monitor exits Programming mode without saving any changes.

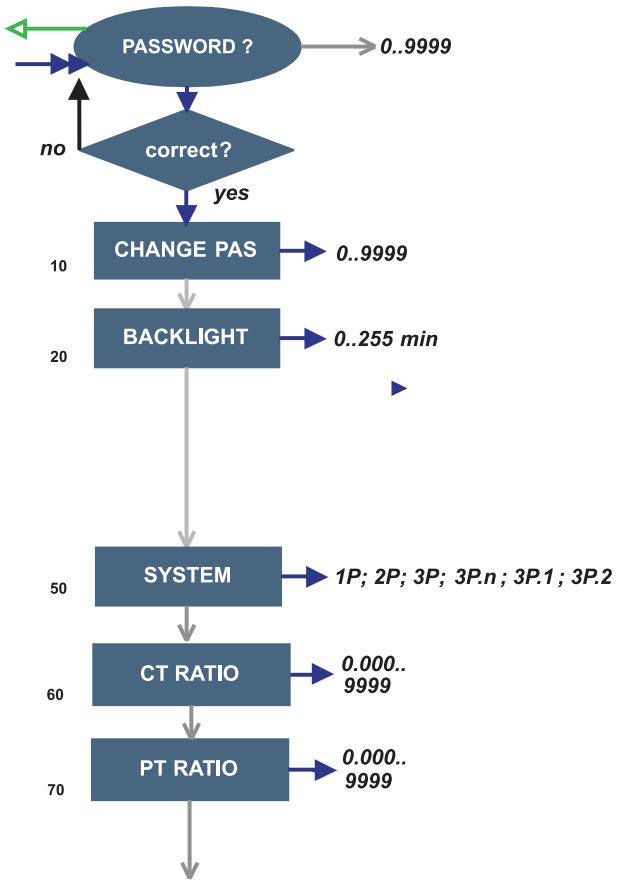
Editing Decimal Point and Multiplier

When the cursor is beneath the last digit on the left, pressing Exit (6) lets you change the decimal point and the multiplier (9) (k or M). The blinking 'dP' (decimal point) text (10) indicates this capability.



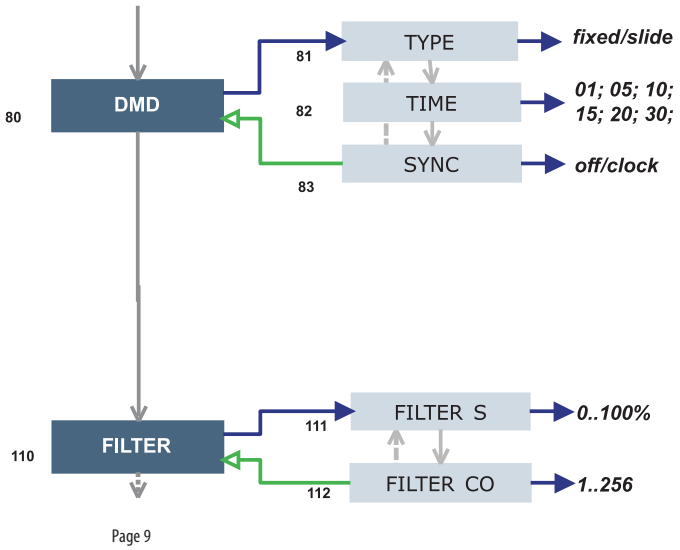
To modify the decimal point position and the multiplier, use the Up and Down arrow (7) to select the desired value.

Configuration Flow Chart



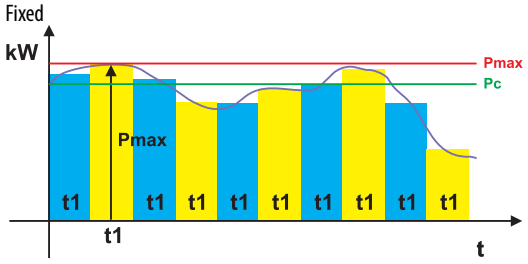
- 10 CHANGE PAS: this function lets you modify the PASS value with a new value (from 0...9999).
- 20 BACKLIGHT: adjusts backlight time from 0...255 minutes (0 = always on).
- 50 SYSTEM: this function lets you select the type of electrical system.

  Refer to pages 17...18 for descriptions and wiring diagrams corresponding to the system type designations, such as, 3P and 3P.n.
- 60 CT RATIO: this function lets you select the value of the CT ratio (primary/secondary ratio of the current transformer being used). Example: if the CT primary (current transformer) has a current of 300 A and the secondary a current of 5 A, the CT ratio corresponds to 60 (300 divided by 5).
- 70 PT RATIO: this function lets you select the value of the PT (VT) ratio (primary/secondary ratio of the potential/voltage transformer being used). Example: if the primary of the connected PT is 20 kV and the secondary is 100V, then the PT ratio corresponds to 200 (20,000 divided by 100).

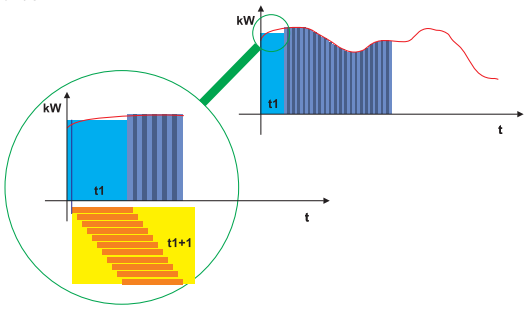


Page 9

Fixed



Slide



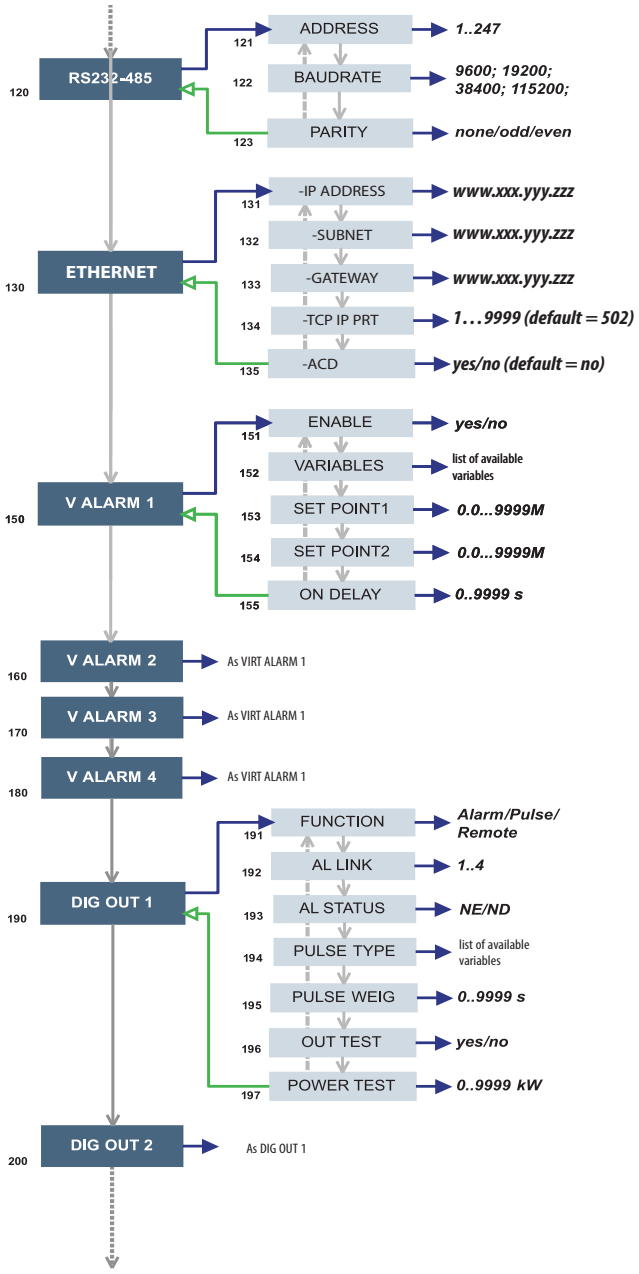
- 80 DMD: This function lets you select the calculation method of the DMD/AVG value of the selected variable.
  - 81 TYPE: select the type of Calculation mode to be used for the DMD/AVG calculation.

    FIXED: The instrument calculates the AVG/DMD value of the measured variable over the selected interval, updates the AVG/DMD value at the end of the interval, then resets and starts a new calculation.

    SLIDE: When first configured, the instrument calculates the AVG/DMD value and updates its value at the beginning after the first selected interval. After the first interval, the instrument calculates the AVG/DMD value every minute, generating a window whose width is the selected interval and that moves forward every minute.
  - 82 TIME: select the time interval for the DMD/AVG calculation. Default is 15 minutes.
  - 83 SYNC: select the Synchronization mode. That is the method that controls the calculation method of the average/demand according to the selected time.
- 110 FILTER: The digital filter makes it possible to stabilize the display of fluctuating measurements.

  See Digital Filtering Operation on page 30.
  - 111 FILTER S: set the operating range (span) of the digital filter. The value is expressed as a % (filter to 0.0 means filter excluded).
  - 112 FILTER CO: set the filtering coefficient of the instantaneous measures. By increasing the value, also the stability and the settling time of the measures are increased.

    IMPORTANT: Some specific menus display only if the relevant modules are installed.

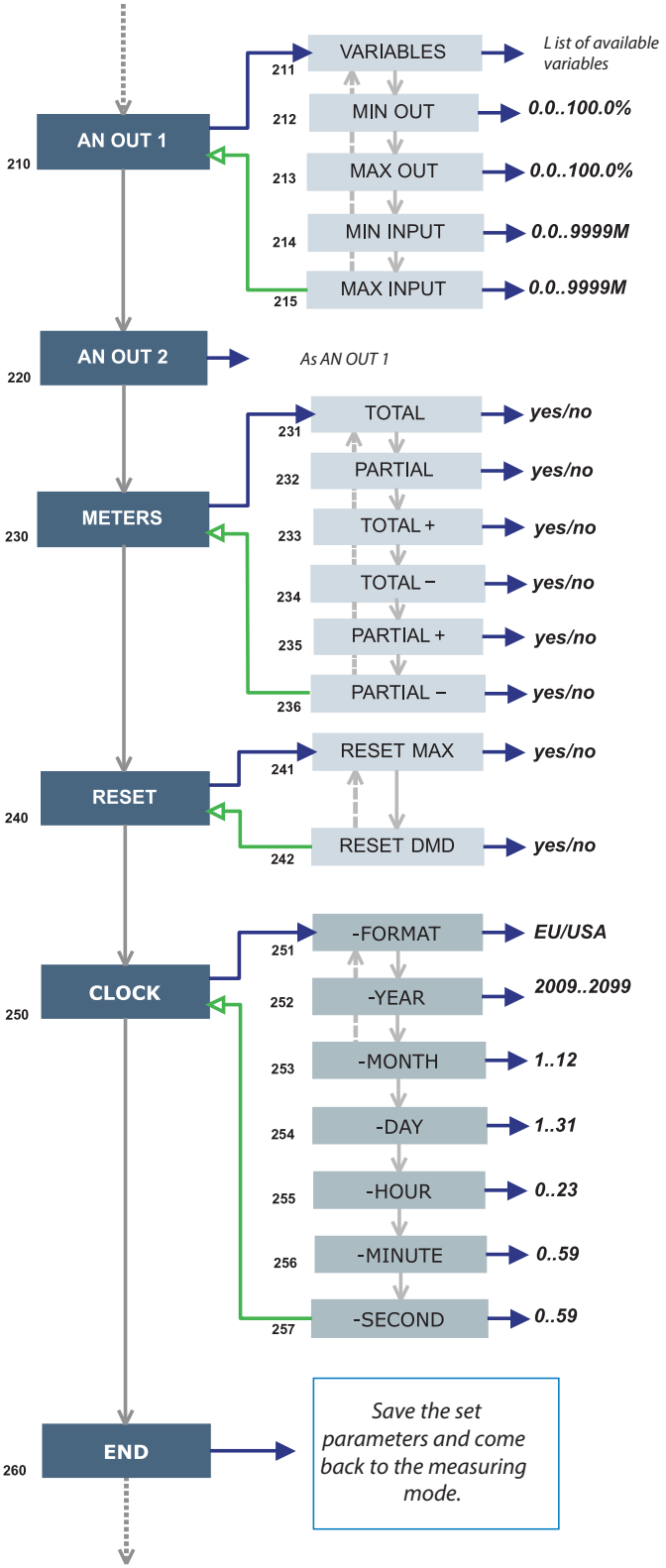


- 120 RS232-485: User settings for the RS-232 and RS-485 serial communication ports.
- 130 ETHERNET: User settings for the Ethernet communication port.
- 150 VIRT AL 1: This function lets you set the alarm parameters.
  - 151 ENABLE: enable (YES) or disable (NO) the alarm.
  - 152 VARIABLES: set the variable to be linked to the alarm.
  - 153 SET 1:set the on alarm set point of the variable.
  - 154 SET 2: set the off alarm set point of the variable.
  - 155 ON DELAY: set a delay on activation of the alarm.
- 190 DIG OUT 1: This function lets you link a virtual alarm to the digital output and to its working parameters.
  - 191 FUNCTION:

    Alarm - the digital output is enabled when the associated alarm status occurs.

    Pulse - the measured energy is retransmitted by the digital output by means of pulses.

    Remote - the digital output can be controlled through a command sent through the serial communication port.
  - 192 AL LINK: select the virtual alarm that it has to be associated.
  - 193 AL STATUS: 'ND' (normally de-energized relay) or 'NE' (normally energized relay).
  - 195 PULSE WEIG: selects the pulse weight (kWh per pulse).
  - 196 OUT TEST: Tests the digital output. YES enables the test, No disables the test.
  - 197 POWER TEST: sets a simulated power value (kW) to test the energy pulse output. The function remains active until you exit the programming menu.



- 210 AN OUT 1: User programming of the analog outputs (0...20 mA).
  - 211 VARIABLES: selects the variable to be retransmitted by means of the analog output.
  - 212 MIN INPUT: minimum value of the variable input range, corresponds to the 'MIN OUTPUT' value of the analog output.
  - 213 MAX INPUT: maximum value of the variable input range corresponds to the 'MAX OUTPUT' value of the analog output.
  - 214 MIN OUTPUT: sets the value expressed as % of the output range (0...20 mA) that corresponds to the minimum measured value.
  - 215 MAX OUTPUT: selects the value expressed as % of the output range (0...20 mA) that corresponds to the maximum measured value.
- 230 METERS: reset the ENERGY METERS choosing among:
  - 231 TOTAL, 222 PARTIAL: resets all energy meters, total and partial.
  - 233 TOTAL +: resets the total meters of imported energy.
  - 234 TOTAL -: resets the total meters of exported energy.
  - 235 PARTIAL +: resets the partial meters of imported energy.
  - 236 PARTIAL -: resets the partial meters of exported energy.
- 240 RESET: Resets the MAX or dmd stored values.
- 250 CLOCK:
  - 251 FORMAT: UE, sets the European time format as 24h (00:00) or sets the time format as 12h (12:00 AM/PM).
  - 252 YEAR: sets the current year.
  - 253 MONTH: sets the current month.
  - 254 DAY: sets the current day.
  - 255 HOUR: sets the current hour.
  - 256 MINUTE: sets the current minute.
  - 257 SECOND: sets the current second.
- 260 END:
  - To save programming changes, press Program/select.
  - To exit the Programming mode without saving any changes, press Exit and confirm by pressing Program/select.
  - If no buttons are pressed for two minutes, the unit exits Programming mode without saving changes.

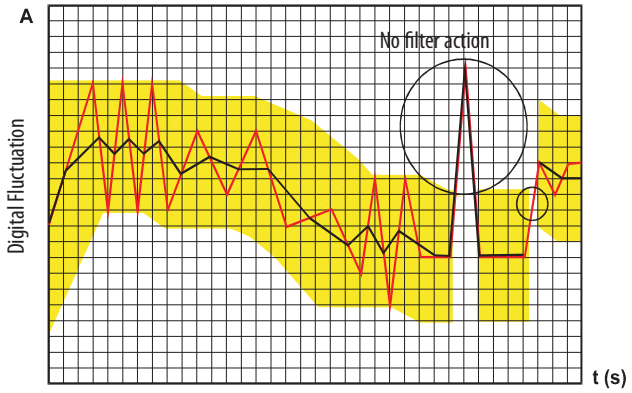
Digital Filtering Operation

Digital filtering smooths out the display of fluctuating values. The parameter FILTER S defines the operating range of the filter. This operating range is represented as a yellow band (each small square is one digit). While the measured value (red curve in figure) is within this band, the filter is active. Once the value exceeds the operating range, the filter is deactivated and a new band is active around the new value. The range of fluctuation (in digits) is a good starting value for such parameters.

The parameter FILTER CO represents the filtering coefficient. The higher the FILTER CO, the smoother the curve of the displayed values (black in figure). There is not a theoretical rule to define this parameter, it is set in the field. One rule is to start with the value of the FILTER S coefficient and then increase FILTER CO until the desired stability is reached.

The digital filter affects the values retransmitted both via serial communication and analog output.

Figure 19 - Digital Filter



Digital Filter Programming Examples

These sections give digital filter programming examples.

Example 1

This example describes how to stabilize the displayed value of the VL-N variable, which fluctuates between 222V and 228V. The parameters of the digital filter have to be programmed as follows.

FILTER S: The variable fluctuates within the mean value whose amplitude is equal to ±0.75% of the full scale rated value of the variable itself (obtained by the following calculation: (228-222)/ 2= ±3V, then ±3*100/400V= ±0.75% where 400V is the phase-neutral rated value of a 1420-V2 unit input). The 'range' parameter, representing the action range of the digital filter, is to be programmed to a value that must be slightly higher than the percentage amplitude of the fluctuation, for example, 1.0%.

FILTER CO: if the new value measured by the instrument is within the action range of the filter, the new displayed value is obtained by adding algebraically the previous value to the variation divided by the filtering coefficient. As a consequence, a value higher than this coefficient implies a longer settling time and therefore a better stability. You generally obtain the best result by setting the filtering coefficient to a value equal to at least 10 times the range parameter value.

In the following example, 1.0*10=10, the stability of the filtering coefficient can be improved by increasing the filtering coefficient; the allowed values are included within 1 and 255.

Example 2

This example describes how to stabilize the value of the displayed System Real Power (W), which fluctuates between 300 kW and 320 kW. In this example, the load is connected to the instrument by means of a 300/5 A CT and a direct measure of the voltage.

The parameters of the digital filter must be programmed as follows.

FILTER S: the variable fluctuates within the mean value whose amplitude is equal to ±2.78% of the full scale rated value of this variable. This value is obtained by the following calculation: (320-300)/ 2= ±10 kW,
then ±10*100/360 kW= ±2,78%, where 360 kW is the rated value of the System Real Power of an 1420-V2 unit input, at the above mentioned CT and VT ratios and obtained by means of the following formula:

$$VLN * VT * IN * CT * 3$$

Where:

VLN = rated input voltage (400V for the V1 input)

VT= primary/secondary ratio of the voltage transformer being used

IN = rated current (5 A)

CT = primary/secondary ratio of the voltage transformer being used (in this example 400*1*5*60*3=360 kW).

The RANGE parameter, representing the digital filtering coefficient action range, is to be programmed to a value that must be slightly higher than the percentage of the fluctuation: for example 3.0%.

FILTER CO: if the new value acquired by the unit is within the filtering action range, the new displayed value is obtained by adding algebraically the previous value to the variation divided by the filtering coefficient. As a consequence, a value higher than this coefficient implies a higher settling time and therefore better stability. Generally speaking, the best result is obtained by setting the filtering coefficient to a value equal to at least 10 times the value of the range parameters. In the example, 3.0*10=30. To improve the stability, you can increase the filtering coefficient; the admitted values are included within 1 and 255.

Example 3

It is necessary to stabilize the value of the displayed variable AL 1 (phase current 1), which fluctuates in the range 470 A and 486 A.

To be able to manage the alarm function and activation and deactivation of the relay, this value is not to be subject to continuous fluctuations. In this example, we have considered using a 500/5 A CT. The parameters of the digital filter are to be programmed as follows.

FILTER S: the variable fluctuates within the mean value whose amplitude is equal to ±1.60% of the full scale rated value of this variable (obtained by means of the calculation: (486-470)/ 2= ±8 A, then ±8*100/500 A= ±1.60% where 500 A is the value referred to the primary of the transformer being used). The 'range' parameter, which represents the action range of the digital filter, is to be programmed to a value slightly higher than the percentage amplitude of the fluctuation, for example 2.0%.

FILTER CO: if the new value acquired by the instrument is within the filtering action range, the new displayed value is calculated algebraically adding to the previous value the variation divided by the filtering coefficient. As a consequence, a higher value of this coefficient implies a higher settling time and therefore a better stability. Generally speaking, the best result is obtained setting the filtering coefficient at a value equal to at least 10 times the value of the range parameter. In the example, 2.0*10=20. To improve the stability you can increase the filtering coefficient; the admitted values are within 1 and 255.

Analog Output Configuration Examples

These examples apply to units with catalog numbers 1420-V1A and 1420-V2A.

Example 1: Power value retransmission by means of a 0...20 mA analog output.

This example describes how to retransmit measured consumed power up to 100 kW by means of a 4...20 mA signal. Program the unit as follows:

- VARIABLE: WΣ (system real power)
- MIN OUT: 20.0% means 4 mA. The calculation to be carried out is the following:
  (100*minimum output) / full scale output =100*4 mA/ 20 mA=20%
- MAX OUT: 100.0% means 20 mA. The calculation to be carried out is:
  (100*maximum output)/full scale output = 100*20 mA/20 mA= 100
- MIN INPUT: 0.0 k; the multiplier k, M, G can be selected on the unit according to the chosen VT and CT values
- MAX INPUT: 100.0 k; the k, M, G multipliers can be selected on the unit according to the selected VT and CT values

Example 2: Retransmission of the power factor (PF) value by means of the 0...20 mA analog output.

In this example, the unit is set up to retransmit the whole range of the allowed values for the PF with a signal from 0...20 mA. The value of the PF variable can vary between C0.001 and L0.000 (for each phase); these values, when retransmitted, correspond to 0 and 20 mA. When the PF value is equal to 1, the analog output value corresponds to the middle of the scale,
that is 10 mA. Program the instrument as follows:

- VARIABLE: PF L1 (or L2 or L3 or PFΣ)
- MIN OUT: 0.0%
- MAX OUT: 100.0%
- MIN INPUT: C0.001 (the C symbol shows a CAPACITIVE value)
- MAX INPUT: L0.001 (the L symbol shows an INDUCTIVE value). L0.001 has been chosen as minimum value to be set to avoid undesirable rapid changing of the outputs

Alarm Configuration Example

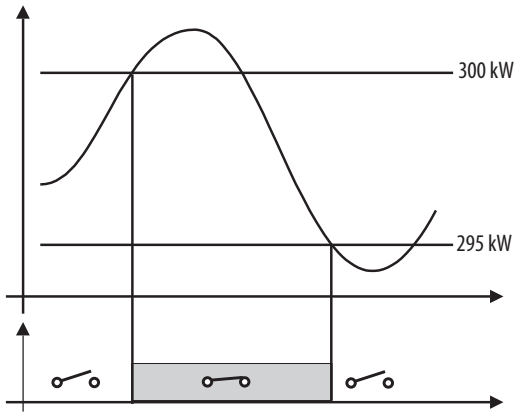
These examples apply to units with catalog numbers 1420-V1P and 1420-V2P.

This example describes an alarm when a measured real power value exceeds a programmed threshold. For example, when 300 kW are exceeded, the alarm occurs and the load controlled by the relay output is disconnected.

IMPORTANT The PowerMonitor 500 unit is not intended to be applied as a protective device.

An 'UP' alarm is selected. The recommended programming is listed below:

- ENABLE: YES
- VARIABLES: W system (W·)
- SET POINT 1: 300 kW
- SET POINT 2: 295 kW
- ON DELAY: set the desired number of seconds, for example 5 seconds



To program a 'DOWN' alarm, configure SET POINT 1 to be a lower value than SET POINT 2.

Communication

EtherNet/IP Communication

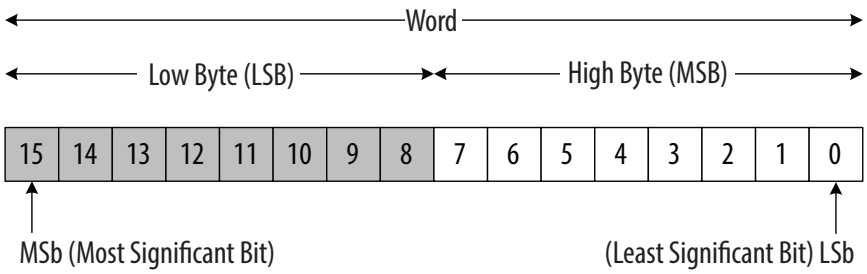
EtherNet/IP communication is supported in PowerMonitor 500 units ordered with optional Ethernet communication. Communication parameters in the power monitor must be configured. Refer to Unit Configuration on page 23.

TIP The Ethernet hardware address (MAC ID) is printed on the unit label.

The PowerMonitor 500 unit provides nine assembly instances containing real-time, maximum, demand, energy, and status data that can be read by a client by using implicit messaging (Class 1) or explicit messaging (Class 3 or UCMM).

Appendix A lists the assembly instances, sizes, data types, and other details. The power monitor returns EtherNet/IP data as little-endian, the same byte order used in the Logix family of programmable controllers.

Figure 20 - Byte Order Example



The power monitor supports the following communication commands:

- CIP Generic Assembly Object (Class 04), Get_Attribute_Single (service code 0x0E) for Attribute 3 (data)
- CIP Generic Assembly Object (Class 04), Get_Attribute_Single (service code 0x0E) for Attribute 4 (size in bytes)

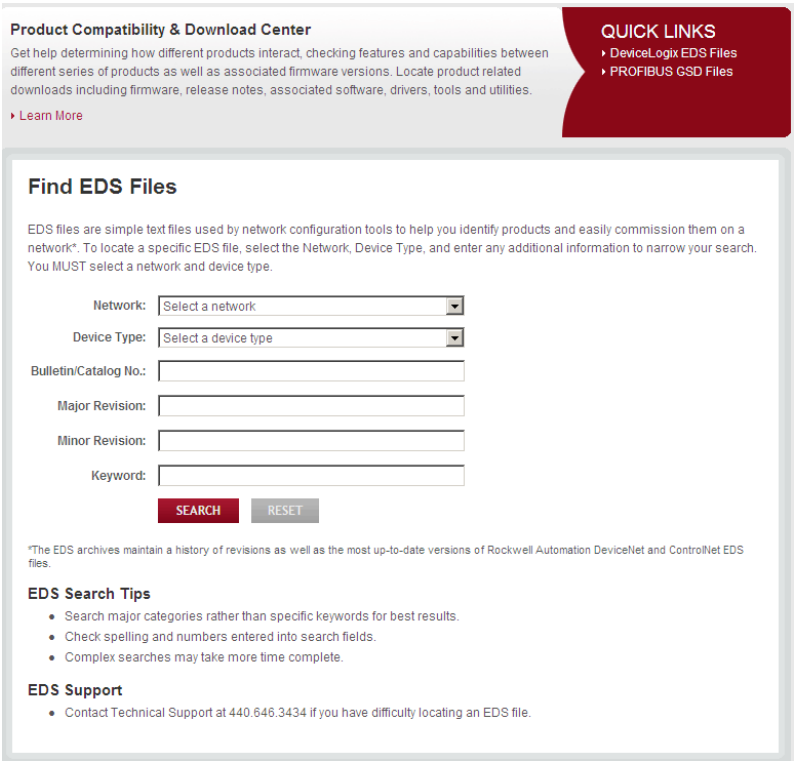
IMPORTANT The power monitor does not support configuration or commands on EtherNet/IP network. To write the configuration of command data, refer to the section on Modbus Communication on page 41.

Refer to Appendix C for additional information on the EtherNet/IP communication implementation in the PowerMonitor 500 unit.

Electronic Data Sheet (EDS)

The EDS file is used to convey device configuration data that is provided by the manufacturer. You can obtain EDS files for the PowerMonitor 500 unit by downloading the file from the following website:

http://www.rockwellautomation.com/rockwellautomation/support/networks/eds.page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EDS files are simple text files used by network configuration tools to help you identify products and easily commission them on a network*. To locate a specific EDS file, select the Network, Device Type, and enter any additional information to narrow your search. You MUST select a network and device type.
Network:
Select a network
Device Type:
Select a device type
Bulletin/Catalog No.:
Major Revision:
Minor Revision:
Keyword:
SEARCH
RESET
*The EDS archives maintain a history of revisions as well as the most up-to-date versions of Rockwell Automation DeviceNet and ControlNet EDS files.
EDS Search Tips
Search major categories rather than specific keywords for best results.
Check spelling and numbers entered into search fields.
Complex searches may take more time complete.
EDS Support
Contact Technical Support at 440.646.3434 if you have difficulty locating an EDS file.

You can install EDS files on your computer by using the EDS Hardware Installation Tool that comes with RSLinx® Classic software, RSNetWorx™ for EtherNet/IP software, or other tools.

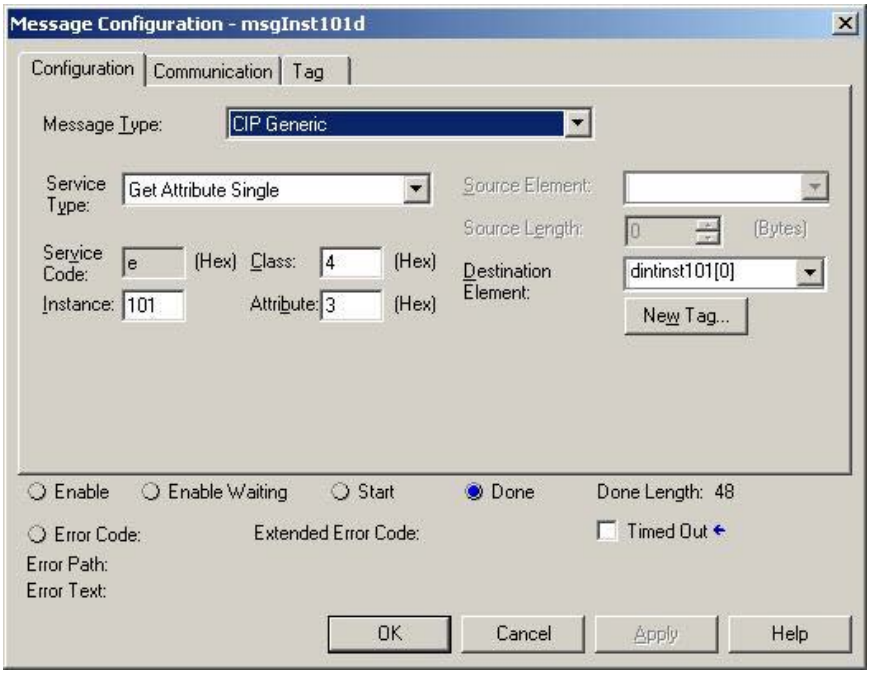
Explicit Messaging - Message Setup with CIP Generic

TIP The Studio 5000 Engineering and Design Environment combines engineering and design elements into a common environment. The first element in the Studio 5000 environment is the Logix Designer application. The Logix Designer application is the rebranding of RSLogix 5000 software.

The following example shows how to set up your message instruction to read from a data table in the power monitor by using a CIP Generic message type for the Logix Designer application. This setup applies to ControlLogix® and CompactLogix™ programmable logic controllers. The CIP Generic message type does not support single element reads or writes. In this example, we read the Real-time Metering Values (Voltage and Current) data table from the power monitor.

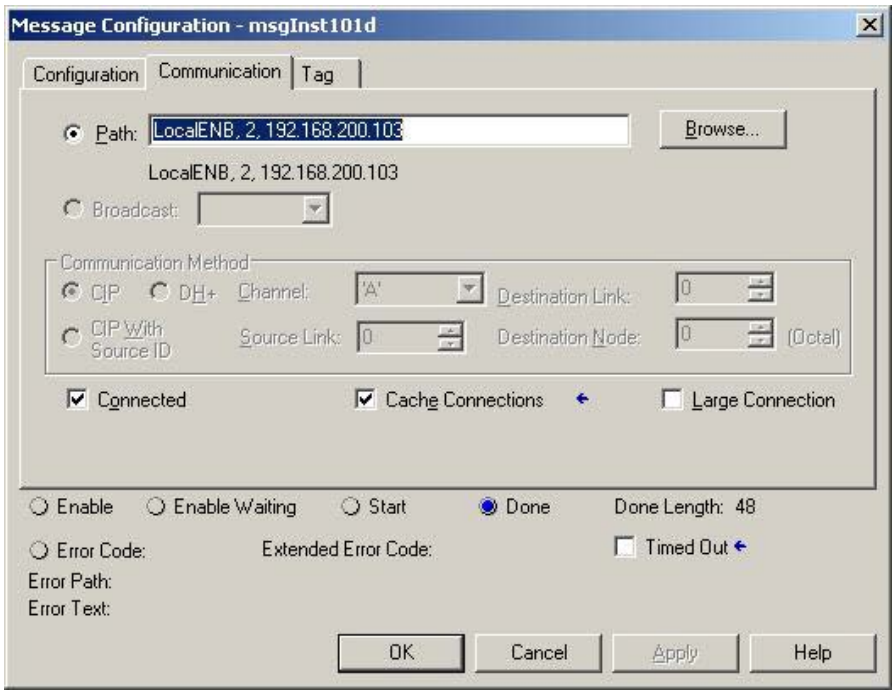
We assume that you are familiar with basic message programming in a Logix controller. Once you have set up the logic, message tag, destination tag, and message instruction, follow these steps to configure the message. This example uses a CompactLogix controller, revision 20.

1. Choose the appropriate parameters in the Message Configuration window.



Parameter	Choice
Message Type	Choose message type CIP Generic.
Service Type	Read: Select service type Get Attribute Single (E hex)
Instance	Refer to Appendix A for the CIP Instance of the data table to read. In this example, the power monitor's Real-time Metering Values (Voltage and Current) data table is instance 101 (decimal).
Class	4 hex
Attribute	3 hex
Destination	Get Attribute Single - This is the first element of the controller tag that stores the data being read. The tag is an array of the applicable data type the same length as the assembly instance; in this example, 12 REAL elements.
Source Element	Not applicable to a Read
Source Length	Not applicable to a Read

2. Click the Communication tab and enter the path and method.



3. Click OK to complete message setup.

Path	Method
<Ethernet Module, Port (always 2 for Ethernet), Power Monitor IP Address>	CIP

Implicit Messaging - Generic Ethernet Module Input Data Connection

The PowerMonitor 500 unit with EtherNet/IP communication supports Class 1 connections to its nine assembly instances. To set up a Class 1 connection to a selected assembly instance with a Logix controller, follow these steps.

1. Open the controller program offline in the Logix Designer application (or online in Program mode if you are using a ControlLogix controller).
2. In the I/O configuration tree, right-click the Ethernet communication module (for example, 1756-EN2T), and choose New Module.
3. From the Communication pull-down menu, choose ETHERNET-MODULE Generic Ethernet Module.

4. Enter the setup parameters as listed in this dialog box and explained in Table 5.

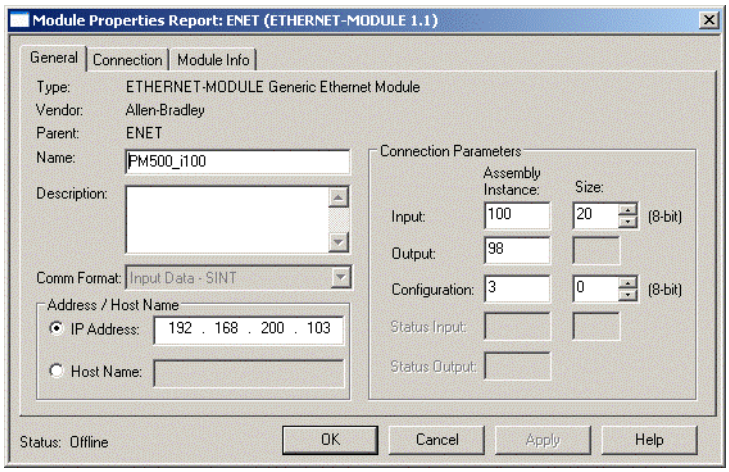


Table 5 - Module Properties Setup Parameters

Item	Choices			
General Tab				
Name	Required; must be IEC 1131-3 compliant			
Description	Optional			
Comm Format	Depends on selected Assembly Instance(1)			
Address/Host Name	IP Address	IP address of target PowerMonitor 500 unit		
	Host Name	Not applicable		
Connection Parameters	Assembly Instance	Size	Comm Format	Data Table Description
Input (select one)	100	20	Input Data - SINT	Product Information
	101	12	Input Data - REAL	Real-time Voltage and Current
	102	18	Input Data - REAL	Real-time Power, PF, Frequency
	103	12	Input Data - REAL	MAX Voltage and Current
	104	17	Input Data - REAL	MAX Power, PF, Frequency
	105	12	Input Data - REAL	Dmd Voltage and Current
	106	17	Input Data - REAL	Dmd Power, PF, Frequency
	107	18	Input Data - REAL	Energy Meters
	108	2	Input Data - INT	Alarm and Output Status
Output	98	N/A	Inst. 98 used for Input Only connection	
	99	N/A	Inst. 99 used for Listen Only connection1	
Configuration	3	0	Instance 3 is a placeholder only	
Connection Tab				
RPI	100 ms or greater			
Inhibit Module	Optional - unchecked by default			
Major Fault	Optional - unchecked by default			
Unicast Connection	Optional - checked by default			

(1) Use the Listen Only connection only when an Input Only connection exists with another controller.

5. When finished, click OK to save the new module.

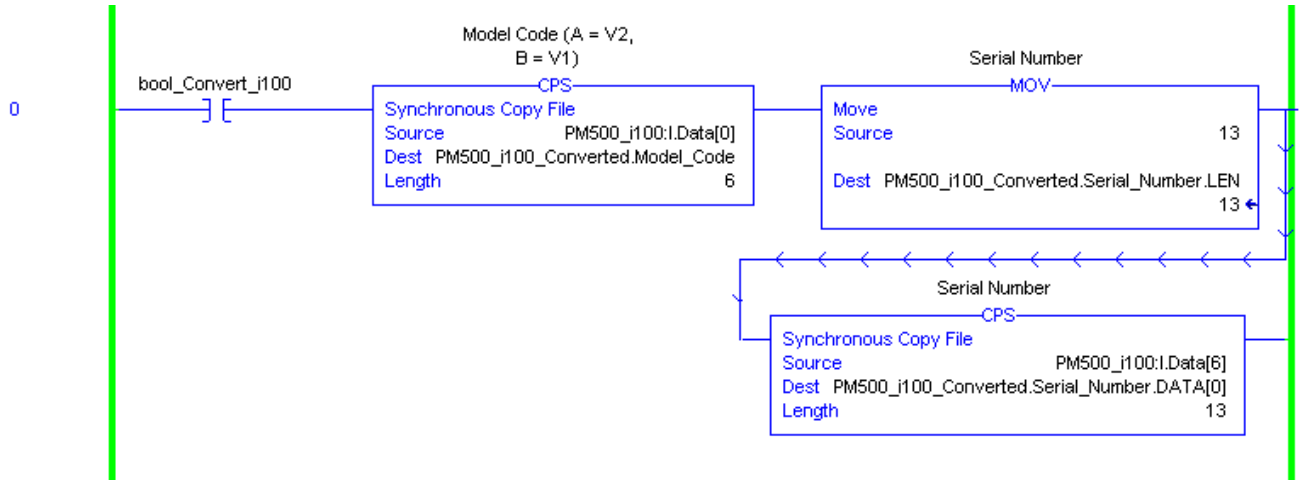
   The module updates its input tag <Name>.I.Data at the Requested Packet Interval (RPI).

PM500_i100:I	{...}	{...}		AB:ETHERNET_...
PM500_i100:I.Data	{...}	{...}	ASCII	SINT[20]
PM500_i100:I.Data[0]	'A'		ASCII	SINT
PM500_i100:I.Data[1]	8		Decimal	SINT
PM500_i100:I.Data[2]	'A'		ASCII	SINT
PM500_i100:I.Data[3]	1		Decimal	SINT
PM500_i100:I.Data[4]	'$00'		ASCII	SINT
PM500_i100:I.Data[5]	0		Decimal	SINT
PM500_i100:I.Data[6]	'B'		ASCII	SINT
PM500_i100:I.Data[7]	'N'		ASCII	SINT
PM500_i100:I.Data[8]	'0'		ASCII	SINT
PM500_i100:I.Data[9]	'6'		ASCII	SINT
PM500_i100:I.Data[10]	'4'		ASCII	SINT
PM500_i100:I.Data[11]	'0'		ASCII	SINT
PM500_i100:I.Data[12]	'0'		ASCII	SINT
PM500_i100:I.Data[13]	'0'		ASCII	SINT
PM500_i100:I.Data[14]	'6'		ASCII	SINT
PM500_i100:I.Data[15]	'0'		ASCII	SINT
PM500_i100:I.Data[16]	'0'		ASCII	SINT
PM500_i100:I.Data[17]	'0'		ASCII	SINT
PM500_i100:I.Data[18]	'A'		ASCII	SINT
PM500_i100:I.Data[19]	'$00'		ASCII	SINT

You can use additional programming to show the data in a different way. Instances 101...107 show data in the REAL, or floating point, format. However, Instance 100 (shown above) combines ASCII characters with numeric byte (SINT) values.

This program displays the contents of Instance 100 in a more human-readable fashion:

- The XIC instruction on tag 'bool_Convert_i100' enables the conversion.
- The first CPS instruction copies the first six bytes of the module input data tag.
- The MOV instruction sets the serial number string length to 13.
- The last CPS instruction copies the serial number from the module input data tag starting at element (byte) 6.



The destinations of the CPS instructions are in a tag with a user-defined data type.

Name: PM500_Inst100

Description:

Members: Data Type Size: 96 byte(s)

Name	Data Type	Style	Description	External Access
Model_Code	SINT	ASCII	Model Code (A = V2, B = V1)	Read Only
Base_Firmware_Version	SINT	Decimal	Firmware Rev Number	Read Only
EtherNetIP_Model_Code	SINT	ASCII	EtherNet/IP Model Code	Read Only
EtherNetIP_Firmware_Version	SINT	Decimal	EtherNet/IP Firmware Rev Number	Read Only
Analog_Output_Model_Code	SINT	ASCII	Analog Output Model Code (If Exists)	Read Only
Analog_Output_Firmware_Revision	SINT	Decimal	Analog Output Firmware Rev	Read Only
Serial_Number	STRING		Serial Number	Read Only
LEN	DINT	Decimal		Read Only
DATA	SINT[82]	ASCII		Read Only

The destination tag shows the data in this way.

PM500_i100_Converted	{...}		
PM500_i100_Converted.Model_Code	'A'	ASCII	Model Code (A = V2, B = V1)
PM500_i100_Converted.Base_Firmware_Version	8	Decimal	Firmware Rev Number
PM500_i100_Converted.EtherNetIP_Model_Code	'A'	ASCII	EtherNet/IP Model Code
PM500_i100_Converted.EtherNetIP_Firmware_Version	1	Decimal	EtherNet/IP Firmware Rev Number
PM500_i100_Converted.Analog_Output_Model_Code	'$00'	ASCII	Analog Output Model Code (If Exists)
PM500_i100_Converted.Analog_Output_Firmware_Revision	0	Decimal	Analog Output Firmware Rev
PM500_i100_Converted.Serial_Number	'BN0640006000A'		Serial Number
PM500_i100_Converted.Serial_Number.LEN	13	Decimal	Serial Number
PM500_i100_Converted.Serial_Number.DATA	{...}	ASCII	Serial Number

Modbus Communication

For a complete description of the MODBUS protocol refer to the following documents that can be downloaded from http://www.modbus.org:

- Modbus_Application_Protocol_ V1_1a
- Modbus_Messaging_Implementation_Guide_V1_0a

Modbus Functions Supported

Modbus RTU is supported in PowerMonitor 500 units ordered with optional RS-485/RS-232 communication. In addition, Modbus TCP is supported in units ordered with optional Ethernet communication. Communication parameters in the power monitor must be configured. Refer to the Unit Configuration section of this manual.

The PowerMonitor 500 unit supports the following Modbus functions:

- 0x03 - Read n Holding Registers
- 0x04 - Read n Input Register
- 0x06 - Write one Holding Register
- 0x10 - Write multiple registers
- 0x08 - Diagnostic (with sub-function code 0x00)
- 0x42 - Read n Special Registers (vendor specific)
- Broadcast mode (write command on address 00h)

In this section, Modbus addresses are indicated in two ways. The 'Modbus address' is expressed as the 6-digit input register address (example: 300123), used with Modbus function code 0x04. The 'Physical address' is the hexadecimal representation of the word address that is to be included in the communication frame.

Modbus function 0x04 can be used with the Modbus address by substituting a 4 for the first digit (example: 400123). With that distinction, functions 0x03 and 0x04 return the same data.

To avoid errors due to signal reflections or line coupling, a termination resistor must be connected at the RS-485 ports of the master station and of the furthest power monitor from the master station. Termination on both ends is necessary even in case of point-to-point connection, with short distances.

The GND connection is optional if a shielded cable is used. For connections longer than 1000 m (3280 ft), a line amplifier is necessary.

Data Types Supported

Format	Description	Bits	Range
INT	Integer	16	-32768…32767
UNIT	Unsigned integer	16	0… 65535
DINT	Double integer	32	$-2^{31}\ldots 2^{31-1}$
UDINT	Unsigned double integer	32	$0\ldots 2^{32-1}$
ULINT	Unsigned long integer	64	$0\ldots 2^{64-1}$
REAL	Single-precision floating-point	32	$-(1+[1-2^{-23}])x2^{127}\ldots 2^{128}$

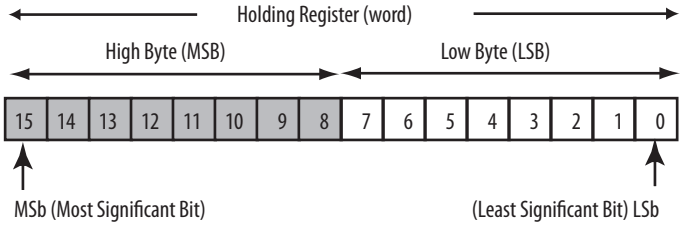
The IEEE754 representation of a 32-bit floating-point number as an integer is defined as follows.

Bits		
31	30…23	22…0
Sign	Exponent	Mantissa

$$Value = (-1)^{sign} * 2^{(Exponent-127)} * 1.Mantissa$$

Modbus Register Format

Modbus registers are 16-bit words organized as shown in the following diagram.


Holding Register (word)
High Byte (MSB)
Low Byte (LSB)
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
MSb (Most Significant Bit)
(Least Significant Bit) LSb

32-bit and 64-bit data types presented as arrays of single registers in LSW (least significant word) to MSW (most significant word) order.

Notes:

PowerMonitor 500 Unit Data Tables

Summary of Data Tables

The Data Table Summary Index table summarizes all data tables available and their general attributes.

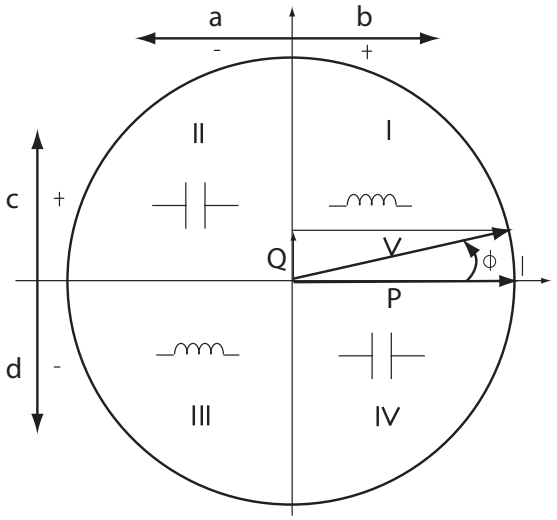
Table 6 - Data Table Summary Index

Name of Data Table	Read	Write	Modbus Starting Address	CIP Assy. Instance ID (decimal)	No. of Elements	Refer to Page
Product Information	X		300001(1)	100	10	47
Real-time Metering Values (voltage and current)	X		300081	101	12	48
Real-time Metering Values (power, PF, frequency)	X		300105	102	18	49
Maximum Metering Values (voltage and current)	X		300337	103	12	50
Maximum Metering Values (power, PF, frequency)	X		300361	104	17	51
DMD Metering Values (voltage and current)	X		300849	105	12	52
DMD Metering Values (power, PF, frequency)	X		300873	106	17	53
Total and Partial Energy Meters - EtherNet/IP Data Table	X		301281	107	9	54
Configuration - Base Unit: Read and Write	X	X	304097	-	79	55
Configuration - Alarms	X	X	Varies	-	16	56
Configuration - RS-485/RS-232 Communication	X	X	304356	-	17	56
Configuration - Analog Outputs: Read and Write	X	X	304609	-	32	57
Analog Output Configuration Parameters	X	X	Varies	-	16	57
Configuration - Digital Outputs: Read and Write	X	X	304865	-	12	58
Commands: Write-only		X	312369	-	45	59
Alarm and Output Status	X		316385	108	2	61

(1) To obtain the physical address, subtract 300001 from the Modbus address and convert the result to hexadecimal. Example: Physical address 0x000B corresponds to Modbus address 300012.

Geometric Representation of Power and Power Factor

Power and power factor values are signed values in accordance with EN 62053 and as indicated in the diagram. Inductive or lagging power factor (Quadrant I and III) is indicated by a positive power factor value. Capacitive or leading power factor is indicated by a negative value.



a = Exported real power

b = Imported real power

c = Imported reactive power

d = Exported reactive power

Data Tables

These tables detail each specific data table and its associated elements, such as address, length, description, and format.

IMPORTANT In the data tables, the Σ symbol is used to indicate 3-phase or system values. The context determines whether this indicates average (for example, voltage) or total (for example, power) values.

Product Information

Table 7 - Table Properties

CIP Assembly Instance	100
No. of Elements	10
Length in Words	10
Data Type	UINT
Data Access	Read Only

Table 8 - Product Information Data Table

Element	Modbus Address	Length (words)	Description / Units	Data Format	Notes
1	300001	1	Base firmware revision	UINT	MSB: ASCII code for model (A = V2, B = V1) LSB: numeric number for revision
2	300002	1	EtherNet/IP module firmware revision	UINT	MSB: ASCII code for model LSB: numeric number for revision
3	300003	1	Analog output module firmware revision (if exists)	UINT	MSB: ASCII code for model LSB: numeric number for revision
4	300033	1	Letter 1 (from SX) Letter 2 (from SX)	UINT	MSB: ASCII code LSB: ASCII code
5	300034	1	Letter 3 (from SX) Letter 4 (from SX)	UINT	MSB: ASCII code LSB: ASCII code
6	300035	1	Letter 5 (from SX) Letter 6 (from SX)	UINT	MSB: ASCII code LSB: ASCII code
7	300036	1	Letter 7 (from SX) Letter 8 (from SX)	UINT	MSB: ASCII code LSB: ASCII code
8	300037	1	Letter 9 (from SX) Letter 10 (from SX)	UINT	MSB: ASCII code LSB: ASCII code
9	300038	1	Letter 11 (from SX) Letter 12 (from SX)	UINT	MSB: ASCII code LSB: ASCII code
10	300039	1	Letter 13 (from SX)	UINT	MSB: ASCII code

Real-time Metering Values (voltage and current)

Table 9 - Table Properties

CIP Assembly Instance	101
No. of Elements	12
Length in Words	24
Data Type	REAL
Data Access	Read Only

Table 10 - Real-time Metering Values (voltage and current) Data Table

Element	Modbus Address	Length (words)	Description / Units	Data Format	Notes
0	300081	2	V L1-N	REAL	
1	300083	2	V L2-N	REAL	
2	300085	2	V L3-N	REAL	
3	300087	2	V L-N ∑	REAL	
4	300089	2	V L1-L2	REAL	
5	300091	2	V L2-L3	REAL	
6	300093	2	V L3-L1	REAL	
7	300095	2	V L-L ∑	REAL	
8	300097	2	A L1	REAL	
9	300099	2	A L2	REAL	
10	300101	2	A L3	REAL	
11	300103	2	A N	REAL	Calculated by instrument base

Real-time Metering Values (power, PF, frequency)

Table 11 - Table Properties

CIP Assembly Instance	102
No. of Elements	18
Length in Words	36
Data Type	REAL
Data Access	Read Only

Table 12 - Real-time Metering Values (power, PF, frequency) Data Table

Element	Modbus Address	Length (words)	Description / Units	Data Format	Notes
0	300105	2	W L1	REAL	
1	300107	2	W L2	REAL	
2	300109	2	W L3	REAL	
3	300111	2	W $\sum$	REAL	
4	300113	2	VA L1	REAL	
5	300115	2	VA L2	REAL	
6	300117	2	VA L3	REAL	
7	300119	2	VA $\sum$	REAL	
8	300121	2	VAR L1	REAL	
9	300123	2	VAR L2	REAL	
10	300125	2	VAR L3	REAL	
11	300127	2	VAR $\sum$	REAL	
12	300129	2	PF L1	REAL	Negative values correspond to lead (C), positive values correspond to lag (L)
13	300131	2	PF L2	REAL	
14	300133	2	PF L3	REAL	
15	300135	2	PF $\sum$	REAL	
16	300137	2	Hz	REAL	
17	300139	2	Asymmetry L-N %	REAL	Also called Unbalance

Maximum Metering Values (voltage and current)

Table 13 - Table Properties

CIP Assembly Instance	103
No. of Elements	12
Length in Words	24
Data Type	REAL
Data Access	Read Only

Table 14 - Maximum Metering Values (voltage and current) Data Table

Element	Modbus Address	Length (words)	Description / Units	Data Format	Notes
0	300337	2	Max V L1-N	REAL	
1	300339	2	Max V L2-N	REAL	
2	300341	2	Max V L3-N	REAL	
3	300343	2	Max V L-N $\sum$	REAL	
4	300345	2	Max V L1-L2	REAL	
5	300347	2	Max V L2-L3	REAL	
6	300349	2	Max V L3-L1	REAL	
7	300351	2	Max V L-L $\sum$	REAL	
8	300353	2	Max A L1	REAL	
9	300355	2	Max A L2	REAL	
10	300357	2	Max A L3	REAL	
11	300359	2	Max A N	REAL	

Maximum Metering Values (power, PF, frequency)

Table 15 - Table Properties

CIP Assembly Instance	104
No. of Elements	17
Length in Words	34
Data Type	REAL
Data Access	Read Only

Table 16 - Maximum Metering Values (power, PF, frequency) Data Table

Element	Modbus Address	Length (words)	Description / Units	Data Format	Notes
0	300361	2	Max W L1	REAL	
1	300363	2	Max W L2	REAL	
2	300365	2	Max W L3	REAL	
3	300367	2	Max W ∑ 3	REAL	
4	300369	2	Max VA L1	REAL	
5	300371	2	Max VA L2	REAL	
6	300373	2	Max VA L3	REAL	
7	300375	2	Max VA ∑	REAL	
8	300377	2	Max VAR L1	REAL	Negative values correspond to lead (C), positive values correspond to lag (L)
9	300379	2	Max VAR L2	REAL	
10	300381	2	Max VAR L3	REAL	
11	300383	2	Max VAR ∑	REAL	
12	300385	2	Max PF L1	REAL	
13	300387	2	Max PF L2	REAL	
14	300389	2	Max PF L3	REAL	
15	300391	2	Max PF ∑	REAL	
16	300393	2	Max Hz	REAL	

DMD Metering Values (voltage and current)

Table 17 - Table Properties

CIP Assembly Instance	105
No. of Elements	12
Length in Words	24
Data Type	REAL
Data Access	Read Only

Table 18 - DMD Metering Values (voltage and current) Data Table

Element	Modbus Address	Length (words)	Description / Units	Data Format	Notes
0	300849	2	DMD V L1-N	REAL	
1	300851	2	DMD V L2-N	REAL	
2	300853	2	DMD V L3-N	REAL	
3	300855	2	DMD V L-N $\sum$	REAL	
4	300857	2	DMD V L1-L2	REAL	
5	300859	2	DMD V L2-L3	REAL	
6	300861	2	DMD V L3-L1	REAL	
7	300863	2	DMD V L-L $\sum$	REAL	
8	300865	2	DMD A L1	REAL	
9	300867	2	DMD A L2	REAL	
10	300869	2	DMD A L3	REAL	
11	300871	2	DMD A N	REAL	

DMD Metering Values (power, PF, frequency)

Table 19 - Table Properties

CIP Assembly Instance	106
No. of Elements	17
Length in Words	34
Data Type	REAL
Data Access	Read Only

Table 20 - DMD Metering Values (power, PF, frequency) Data Table

Element	Modbus Address	Length (words)	Description / Units	Data Format	Notes
0	300873	2	DMD W L1	REAL	
1	300875	2	DMD W L2	REAL	
2	300877	2	DMD W L3	REAL	
3	300879	2	DMD W $\sum$	REAL	
4	300881	2	DMD VA L1	REAL	
5	300883	2	DMD VA L2	REAL	
6	300885	2	DMD VA L3	REAL	
7	300887	2	DMD VA $\sum$	REAL	
8	300889	2	DMD VAR L1	REAL	Negative values correspond to lead (C), positive values correspond to lag (L)
9	300891	2	DMD VAR L2	REAL	
10	300893	2	DMD VAR L3	REAL	
11	300895	2	DMD VAR $\sum$	REAL	
12	300897	2	DMD PF L1	REAL	
13	300899	2	DMD PF L2	REAL	
14	300901	2	DMD PF L3	REAL	
15	300903	2	DMD PF $\sum$	REAL	
16	300905	2	DMD Hz	REAL	

Total and Partial Energy Meters - EtherNet/IP Data Table

Table 21 - Table Properties

CIP Assembly Instance	107
No. of Elements	18
Length in Words	36
Data Type	REAL
Data Access	Read Only

Table 22 - Total and Partial Energy Meters - EtherNet/IP Data Table

Element	Length (words)	Description / Units	Data Format	Notes
0	2	Total kWh+	REAL	Range 0.0 … 999,999.999
1	2	Total GWh+	REAL	Range 0 … 9,999,999
2	2	Total kVARh+	REAL	Range 0.0 … 999,999.999
3	2	Total GVARh+	REAL	Range 0 … 9,999,999
4	2	Total kWh-	REAL	Range 0.0 … 999,999.999
5	2	Total GWh-	REAL	Range 0 … 9,999,999
6	2	Total kVARh-	REAL	Range 0.0 … 999,999.999
7	2	Total GVARh-	REAL	Range 0 … 9,999,999
8	2	Partial kWh+	REAL	Range 0.0 … 999,999.999
9	2	Partial GWh+	REAL	Range 0 … 9,999,999
10	2	Partial kVARh+	REAL	Range 0.0 … 999,999.999
11	2	Partial GVARh+	REAL	Range 0 … 9,999,999
12	2	Partial kWh-	REAL	Range 0.0 … 999,999.999
13	2	Partial GWh-	REAL	Range 0 … 9,999,999
14	2	Partial kVARh-	REAL	Range 0.0 … 999,999.999
15	2	Partial kVARh-	REAL	Range 0 … 9,999,999
16	2	Hours counter	REAL	
17	2	Minutes counter	REAL	Range 0 … 59

Table 23 - Energy Metering Values Modbus - Read-only

Modbus Address	Length (words)	Description / Units	Data Format	Notes
301281	4	Total kWh+	ULINT	Values in Wh or varh
301285	4	Total kVARh+	ULINT	
301289	4	Total kWh-	ULINT	
301293	4	Total kVARh-	ULINT	
301297	4	Partial kWh+	ULINT	
301301	4	Partial kVARh+	ULINT	
301305	4	Partial kWh-	ULINT	
301309	4	Partial kVARh-	ULINT	
301313	4	Hours counter	ULINT	Hours value: integer part got from the division of the counter by 100 Minutes value: rest of the previous computation (decimal part)

Table 24 - Configuration - Base Unit: Read and Write

Modbus Address	Length (words)	Description / Units	Data Format	Notes
304097	1	Password	UINT	Minimum valid value: 0d Maximum valid value: 9999d
304098	1	Electrical system selection	UINT	Value =0: 1P (1-phase 2-wire) Value =1: 2P (2-phase 3-wire) Value=2: 3P (3-phase 3-wire) Value=3: 3P2 (3-phase 2-wire) one current and 1-phase (L1) to neutral voltage measurement) Value=4: 3P1 (3-phase 4-wire one current and 3-phase to neutral voltage measurements) Value=5: 3PN (default =3PN)
304099	1	Reserved	UINT	Value = 5
304101	1	Backlight mode	UINT	The timing backlight is programmable from 0…255 minutes (0 = always ON)
304107	1	DMD - Calculation	UINT	Selection of the DMD calculation mode Value=0: Fixed Value=1: Slide - only for W$\sum$ and VA$\sum$
304108	1	DMD - Time interval	UINT	Value=0: 1 min Value=1: 5 min Value=2: 10 min Value=3: 15 min Value=4: 20 min Value=5: 30 min Value=6: 60 min
304110	1	DMD - Synchronisation	UINT	Synchronisation selection mode Value=0: OFF Value=1: Clock
304121	2	CT - Current transformer ratio	REAL	1.0…9999.0
304123	2	VT(PT) - Voltage transformer ratio	REAL	1.0…9999.0
304127	2	Filter Span parameter	REAL	Value min = 0.0 Value max = 100.0 (Disabled = 0.0)
304129	2	Filter Coefficient	REAL	Value min = 1.0 Value max = 256.0
304177	16	Virtual Alarm AL1 (LED 1)	Customized	Refer to the Table 25
304193	16	Virtual Alarm AL2 (LED 2)	Base Alarm data structure	
304209	16	Virtual Alarm AL3 (LED 3)		
304225	16	Virtual Alarm AL4 (LED 4)		

Table 25 - Configuration - Alarms

Modbus Address	Length (words)	Description / Units	Data Format	Notes
Block address +0	1	Alarm N - Enabling	UINT	Value=1: alarm N enabled Value=0: alarm N disabled All other values are considered as value=0
Block address +1	1	Alarm N - Variable type to be linked to	UINT	Refer to the Connected Variable List (Table 43)
Block address +2	1	Alarm N - Delay ON activation (s)	UINT	Value min=0 Value max=3600 If the set value exceeds the allowed range, the instrument automatically sets the value to 0
Block address +3	2	Alarm N – Set point 1	REAL	Value min = -9999M Value max = 9999M If the set value exceeds the allowed range, the instrument automatically sets the value to 0.000
Block address +5	2	Alarm N – Set point 2	REAL	Value min = -9999M Value max = 9999M If the set value exceeds the allowed range, the instrument automatically sets the value to 0.000
Block address +7	9	Reserved		

Table 26 - Configuration - RS-485/RS-232 Communication

Modbus Address	Length (words)	Description / Units	Data Format	Notes
304356	1	Clock format	UINT	0=24h/12h 1=AM-PM
304357	1	Clock daylight-saving	UINT	Value=0: NO Value=1: YES
304358	1	Clock calendar: Year (1)	UINT	2009…2099
304359	1	Clock calendar: Month (1)	UINT	1…12
304360	1	Clock calendar: Day (1)	UINT	1…31
304361	1	Clock: Hour(1)	UINT	0…23
304362	1	Clock: Minutes (1)	UINT	0…59
304363	1	Clock: Seconds (1)	UINT	0…59
304364	1	Daylight-saving: month in which to increase the hour (+1H)	UINT	1…12
304365	1	Daylight-saving: Sunday in which to increase the hour (+1H)	UINT	0…4 (0= last Sunday of the month)
304366	1	Daylight-saving: hour in which to increase the hour (+1H)	UINT	0…23 (24h format only)
304367	1	Daylight-saving: month in which to decrease the hour (-1H)	UINT	1…12
304368	1	Daylight-saving: Sunday in which to decrease the hour (-1H)	UINT	0…4 (0= last Sunday of the month)
304369	1	Daylight-saving: hour in which to decrease the hour (-1H)	UINT	0…23 (24h format only)
304401	1	RS-485 instrument address selection(2)	UINT	Value min = 1 Value max = 247 If the set value exceeds the allowed range, the instrument automatically sets the value to 1
304402	1	RS-485 baud rate selection(2)	UINT	Value=0: 9600 Value=1: 19200 Value=2: 38400 Value=3: 115200 All other values are considered as value=0
304403	1	RS-485 parity selection (2)	UINT	Value=0: No parity Value=1: Odd parity Value=2: Even parity All other values are considered as value=0

(1) The values are updated only after sending the 'update clock' command.

(2) The values are updated only after sending the 'update serial communication setting' command or switching off and on the instrument.

Table 27 - Configuration - Analog Outputs: Read and Write

Modbus Address	Length (words)	Description / Units	Data Format	Notes
304609	16	Analog output A0: parameters configuration	CUSTOM	Refer to Table 28
304625	16	Analog output A1: parameters configuration	CUSTOM	

Table 28 - Analog Output Configuration Parameters

Modbus Address	Length (words)	Description / Units	Data Format	Notes
Block address +0	1	Type of the variable that is linked to the N analog output	UINT	
Block address +1	2	Minimum electric value of the N analog output	REAL	Value min = 0 Value max = 9,999,000
Block address +3	2	Maximum electric value of the N analog output	REAL	
Block address +5	2	Minimum output value of the N analog output	REAL	Value min = 0.0 Value max = 100.0
Block address +7	2	Maximum output value of the N analog output	REAL	
Block address +9	7	Reserved		

Table 29 - Configuration - Digital Outputs: Read and Write

Modbus Address	Length (words)	Description / Units	Data Format	Notes
304865	1	Digital output channel 1: enabling	UINT	0=Remote 1=Alarm 2= Pulse
304866	1	Digital output channel 1: output working mode	UINT	0=NO 1=NC (only if selected 'Alarm' type)
304867	1	Digital output channel 1: linked alarm	UINT	0=AL1 1=AL2 2=AL3 3=AL4 (only if selected 'Alarm' type)
304868	1	Channel 1: linked counter variable	UINT	0=Total kWh+ 1=Total kVARh+ 2=Total kWh- 3=Total kVARh- 4=Partial kWh+ 5= Partial kVARh+ 6= Partial kWh- 7= Partial kVARh-
304869	2	Digital output channel 1: pulse	REAL	Pulse weight (kWh/pulse or kVARh/pulse) Value min = 0.001 Value max = 9999.9
304871	1	Digital output channel 2: enabling	UINT	0=Remote 1=Alarm 2= Pulse
304872	1	Digital output channel 2: output working mode	UINT	0=NO 1=NC (only if selected 'Alarm' type)
304873	1	Digital output channel 2: linked alarm	UINT	0=AL1 1=AL2 2=AL3 3=AL4 (only if selected 'Alarm' type)
304874	1	Channel 2: linked counter variable	UINT	0=Total kWh+ 1=Total kVARh+ 2=Total kWh- 3=Total kVARh- 4=Partial kWh+ 5= Partial kVARh+ 6= Partial kWh- 7= Partial kVARh-
304875	2	Digital output channel 2: pulse	REAL	Pulse weight (kWh/pulse or kVARh/pulse) Value min = 0.001 Value max = 9999.0

Table 30 - Commands: Write-only

Modbus Address	Length (words)	Description / Units	Data Format	Notes
312369	1	Get clock values	UINT	Value=1 - command executed; Value≠1 - no effect
312370	1	Set clock values	UINT	Value=1 - date and time set
312374	1	Enable optional pulse (digital) outputs	UINT	Value=1 - module enabled; Value=0 - module disabled
312376	1	Enable optional serial communication	UINT	Value=1 - module enabled; Value=0 - module disabled
312546	1	Reset all pulse (digital) outputs (digital output 1 or 2)	UINT	Value=1 - command executed; Value≠1 - no effect
312547	1	Set pulse (digital) output 1	UINT	Value=0 - reset output; Value=1 - set output; Other values - no effect
312548	1	Set pulse (digital) output 2	UINT	Value=0 - reset output; Value=1 - set output; Other values - no effect
312549	1	Set all pulse (digital) outputs (digital output 1 or 2)	UINT	Value=1 - command executed; Value≠1 - no effect
312802	1	Reset V L1-N	UINT 16	Bit0 = 1: Reset Max Value Bit1 = 1: Reset DMD value Bits 2 . . . 15: Reserved
312803	1	Reset V L2-N	UINT 16	
312804	1	Reset V L3-N	UINT 16	
312805	1	Reset V L-N $\sum$	UINT 16	
312806	1	Reset V L1-L2	UINT 16	
312807	1	Reset V L2-L3	UINT 16	
312808	1	Reset V L3-L1	UINT 16	
312809	1	Reset V L-L $\sum$	UINT 16	
312810	1	Reset A L1	UINT 16	
312811	1	Reset A L2	UINT 16	
312812	1	Reset A L3	UINT 16	
312813	1	Reset A N	UINT 16	

Table 30 - Commands: Write-only

Modbus Address	Length (words)	Description / Units	Data Format	Notes
312814	1	Reset W L1	UINT 16	Bit0 = 1: Reset Max Value Bit1 = 1: Reset DMD value Bits 2 . . . 15: Reserved
312815	1	Reset W L2	UINT 16	
312816	1	Reset W L3	UINT 16	
312817	1	Reset W $\sum$	UINT 16	
312818	1	Reset VA L1	UINT 16	
312819	1	Reset VA L2	UINT 16	
312820	1	Reset VA L3	UINT 16	
312821	1	Reset VA $\sum$	UINT 16	
?312822	1	Reset VAR L1	UINT 16	
312823	1	Reset VAR L2	UINT 16	
312824	1	Reset VAR L3	UINT 16	
312825	1	Reset VAR $\sum$	UINT 16	
312826	1	Reset PF L1	UINT 16	
312827	1	Reset PF L2	UINT 16	
312828	1	Reset PF L3	UINT 16	
312829	1	Reset PF $\sum$	UINT 16	
312830	1	Reset Hz	UINT 16	
313569	1	Reset Total kWh+	UINT	Value=1 - command executed
313570	1	Reset Total kVARh+	UINT	Value=1 - command executed
313571	1	Reset Total kWh-	UINT	Value=1 - command executed
313572	1	Reset Total kVARh-	UINT	Value=1 - command executed
313573	1	Reset Partial kWh+	UINT 16	Value=1 - command executed
313574	1	Reset Partial kVARh+	UINT 16	Value=1 - command executed
313575	1	Reset Partial kWh-	UINT 16	Value=1 - command executed
313576	1	Reset Partial kVARh-	UINT 16	Value=1 - command executed

Alarm and Output Status

Table 31 - Table Properties

CIP Assembly Instance	108
No. of Elements	2
Length in Words	2
Data Type	INT
Data Access	Read Only

Table 32 - Alarm and Output Status: Read Only Mode Data Table

Element	Modbus Address	Length (words)	Description / Units	Data Format	Notes
0	316385	1	Virtual alarm	UINT	Bit value: 0 = OFF Bit value: 1 = ON Bit position: 0: Virtual alarm 1 1: Virtual alarm 2 2: Virtual alarm 3 3: Virtual alarm 4
1	316386	1	Output (port)	UINT	Bit value 0 = OFF Bit value 1 = ON (Important: only if the port is not linked to the counter) Bit position (LSB concept): 0: Port1 1: Port2
2 (see Important)	316387	1	HW modules configuration	UINT	Bit value: 0 = module not present 1 = module present Bit position 0: Relay output 1: Reserved 2: RS-485/RS-232 port 3: Ethernet Modbus 4: Reserved 5: Analog output 6: Reserved 7: Reserved 8: EtherNet/IP 9…15: Reserved

IMPORTANT A Get_Attribute_Single command returns only elements 0 and 1 of this table. The information in element 2 is accessible in the Identity Object, Class 0x01.

Notes:

Technical Specifications

Table 33 - Input Specifications

Attribute	Value
Rated inputs	System type: 1, 2, or 3-phase
Current type	Galvanic insulation by means of built-in CTs
Current range (by CT)	5 A nom (6 A max)
Voltage (by direct connection or VT/PT)	V1: 120/208V LL; V2: 400/690V LL
Accuracy (Display and RS-485) (@25 °C ±5 °C, R.H. ≤ 60%, 48…62 Hz)	Nom current (In): see below, Nom voltage (Un): see below
V1 model	In: 5 A, Imax: 6 A; Un: 40…144V LN (70…250V LL)
V2 model	In: 5 A, max current (Imax): 6 A; Un: 160…480V LN (277…830V LL)
Current all models	From 0.01…0.05 In: ±(1.0% of reading (RDG) + 2 digit (DGT)); From 0.05 In to Imax: ±(0.5% RDG +2 DGT)
Phase-neutral voltage	In the range Un: ±(0.5% RDG +1 DGT)
Phase-phase voltage	In the range Un: ±(1.0% RDG +1 DGT)
Frequency	±0.1 Hz (45…65 Hz)
Real and apparent power	0.01 In to 0.05 In, PF 1: ±(2% RDG +1 DGT); From 0.05 In to Imax PF 0.5L, PF1, PF 0.8C: ±(1.0% RDG+1 DGT)
Power factor (PF)	±[0.001+0.5% (1.000 - 'PF RDG')]
Reactive power	0.1 In to Imax, senf 0.5L/C: ±(2.0% RDG +1 DGT) 0.05 In to 0.1 In, senf 0.5L/C: ±(2.5% RDG +1 DGT); 0.05 In to Imax, senf 1.0: ±(2.0% RDG+1 DGT) 0.02 In to 0.05 In, senf 1: ±(2.5% RDG+1 DGT)
Real energy	Class 1 according to EN62053-22, ANSI C12.20 Class B according to EN50470-3
Reactive energy	Class 2 according to EN62053-23, ANSI C12.1
Start up current	5 mA
Energy additional errors	According to EN62053-22, ANSI C12.20, Influence quantities Class B according to EN50470-3, EN62053-23, ANSI C12.1
Total harmonic distortion (THD)	±1% FS (FS: 100%) V2: Imin: 5 mA rms; Imax: 15 Ap; Umin: 30V rms; Umax: 585Vp V1: Imin: 5 mA rms; Imax: 15 Ap; Umin: 30V rms; Umax: 585Vp
Temperature drift	≤ 200 ppm/°C
Sampling rate	3200 samples/s @ 50 Hz, 3840 samples/s @ 60 Hz
Measurements	See List of Connectable Variables on page 69
Method	TRMS measurements of distorted wave forms
Coupling type	By means of CTs
Crest factor	≤3 (15 A max peak)
Current overloads	
Continuous	6 A, @ 50 Hz
For 500 ms	120 A, @ 50 Hz

Table 33 - Input Specifications

Attribute	Value
Voltage overloads	
Continuous	1.2 Un
For 500 ms	2 Un
Input impedance	
400VL-L (V2)	> 1.6 MΩ
208VL-L (V1)	> 1.6 MΩ
5(6)A	< 0.2 VA
Frequency	40…440 Hz

Table 34 - Pulse (digital) Output Specifications (P option)

Attribute	Value
Physical outputs	2
Purpose	For either alarm output or digital output
Type	Relay, SPDT type AC 1-5 A @ 250V AC; AC 15-1.5 A @ 250V AC DC 12-5A @ 24V DC; DC 13-1.5A @ 24V DC
Configuration	By means of the front keypad
Function	The outputs can work as alarm outputs but also as digital outputs, communication controlled outputs, or in any other combination
Alarms	Up alarm and down alarm linked to the virtual alarms, other details see Virtual alarms
Response time, min	≤200 ms, filters excluded. Set-point on-time delay: '0 s'
Pulse	
Signal retransmission	Total: +kWh, -kWh, +kVARh, -kVARh. Partial: +kWh, -kWh, +kVARh, -kVARh
Pulse type	The above listed variables can be connected to any output
Pulse duration	Programmable from 0.001…10.00 kWh/kVARh per pulse. ≥100 ms <120 ms (ON), ≥120 ms (OFF), according to EN62052-31
Communication controlled outputs	The activation of the outputs is managed through the serial communication port
Insulation	See Table 42 Isolation Between Inputs and Outputs (1 minute)

Table 35 - Analog Output Specifications (A option)

Attribute	Value
Number of outputs	2
Accuracy (@ 25 °C ±5 °C, R.H. ≤ 60%)	± 0.2% of full scale
Range	0…20 mA
Configuration	By means of the front keypad
Signal retransmission	The signal output can be connected to any instantaneous variable. See List of Connectable Variables on page 69
Scaling factor	Programmable within the whole range of retransmission; it allows the retransmission management of all values from 0…20 mA DC
Response time	≤400 ms typical (filter excluded)
Ripple	≤1% (according to IEC 60688-1, EN 60688-1)
Total temperature drift	≤500 ppm/°C
Load	≤ 600 Ω
Insulation	See Table 42 Isolation Between Inputs and Outputs (1 minute)

Table 36 - Serial RS-485/RS-232 Communication Specifications (485 option)

Attribute	Value
RS-485/RS-422 port	
Type	Multidrop, bidirectional (static and dynamic variables)
Connections 2-wire max distance 1000 m, termination directly on the module	
Addresses	247, selectable by means of the front key-pad or through the software
Protocol	Modbus RTU
Data (bidirectional)	
Dynamic (reading only)	System and phase variables: see the Modbus register maps
Static (reading and writing only)	All the configuration parameters; see the Modbus register maps
Data format	1 start bit, 8 data bit, no/even/odd parity,1 stop bit
Communication rate	Selectable: 9.6, 19.2, 38.4, 115.2 Kbps
Driver input capability	1/5 unit load. Max 160 transceivers on the same bus
Insulation	See Table 42 Isolation Between Inputs and Outputs (1 minute)
RS-232 port	
Type	Bidirectional (static and dynamic variables)
Connections	3 wires. Max distance 15 m
Protocol	Modbus RTU

Table 36 - Serial RS-485/RS-232 Communication Specifications (485 option)

Attribute	Value
Data (bidirectional)	
Dynamic (reading only)	System and phase variables: see the Modbus register tables
Static (reading and writing only)	All the configuration parameters; see the Modbus register tables
Data format	1 start bit, 8 data bit, no/even/odd parity,1 stop bit
Communication rate	Selectable:9.6, 19.2, 38.4, 115.2 Kbps
Note	With the rotary switch (on the back of the basic unit) in lock position, modification of programming parameters and reset command by means of serial communication are not allowed. In this case just data reading is allowed
Insulation	See Table 42 Isolation Between Inputs and Outputs (1 minute)

Table 37 - Energy Meters

Attribute	Value
Meters	
Total	4 (9+1 digit)
Partial	4 (9+1 digit)
Pulse output	Connectable to total and/or partial meters
Energy meter recording	Storage of total and partial energy meters. Energy meter storage format (EEPROM) Min. -9,999,999,999.9 kWh/kVARh Max. 9,999,999,999.9 kWh/kVARh
Energy meters	
Total energy meters	+kWh, +kVARh, -kWh, -kVARh
Partial energy meters	+kWh, +kVARh, -kWh, -kVARh

Table 38 - Display, Status Indicators, and Commands

Attribute	Value
Display refresh time	≤ 100 ms
Display	4 lines, 4-DGT, 1 lines, 10-DGT
Type	LCD, single color backlight
Digit dimensions	4-DGT: h 9.5 mm; 10-DGT: h 6.0 mm
Instantaneous variables read-out	4-DGT
Energy variables read-out	Imported Total/Partial: 9+1DGT or 10DGT; Exported Total/Partial: 9+1DGT or 10DGT (with '-' sign)
Run hours counter	8+2 DGT (99.999.999 hours and 59 minutes max)
Overload status	EEEE indication when the value being measured is exceeding the 'Continuous inputs overload' (max measurement capacity)
Max and min indication	Max instantaneous variables: 9999; energies: 9 999 999 99.9 or 9 999 999 999. Min instantaneous variables: 0.000; energies 0.0
Front position status indicators	
Virtual alarms	4 red status indicators available in case of virtual alarm (AL1-AL2- AL3-AL4). Note that the real alarm is just the activation of the proper static or relay output if the proper module is available
Energy consumption	Red status indicator (only kWh)

Table 38 - Display, Status Indicators, and Commands

Attribute	Value
kWh pulsating	0.001 kWh/kVARh by pulse if the Ct ratio by VT ratio is ≤ 7 0.01 kWh/kVARh by pulse if the Ct ratio by VT ratio is ≥7.1 ≤ 70.0 0.1 kWh/kVARh by pulse if the Ct ratio by VT ratio is ≥70.1 ≤700.0 1 kWh/kVARh by pulse if the Ct ratio by VT ratio is ≥700.1 ≤ 7000 10 kWh/kVARh by pulse if the Ct ratio by VT ratio is ≥7001 ≤ 70.00k 100 kWh/kVARh by pulse if the Ct ratio by VT ratio is >70.01k max frequency: 16 Hz, according to EN50470-1
Rear position status indicators	
On the base	Green as power-on
On communication modules	Two status indicators: one for TX (green) and one for RX (amber)
Key-pad	For variable selection, programming of the instrument working parameters, 'dmd', 'max', total energy and partial energy Reset

Table 39 - Main Functions

Attribute	Value
Password	Numeric code of max 4 digits; 2 protection levels of the programming data
1st level	Password '0', no protection
2nd level	Password from 1…9999, all data are protected
System selection	
System 3-Ph.n unbalanced load	3-phase (4-wire)
System 3-Ph. unbalanced load	3-phase (3-wire), three currents and 3-phase to phase voltage measurements, or in case of Aaron connection two currents (with special wiring on screw terminals) and 3-phase to phase voltage measurements
System 3-Ph.1 balanced load	3-phase (3-wire), one current and 3-phase to phase voltage measurements 3-phase (4-wire), one current and 3-phase to neutral voltage measurements
System 3-Ph.2 balanced load	3-phase (2-wire), one current and 1-phase (L1) to neutral voltage measurement
System 2-Ph	2-phase (3-wire)
System 1-Ph	1-phase (2-wire)
Transformer ratio	
VT (PT)	1.0…999.9 / 1000…9999
CT	1.0…999.9 / 1000…9999 (up to 50 kA in case of CT with 5 A secondary current)
Filter	
Operating range	Selectable from 0…100% of the input display scale
Filtering coefficient	Selectable from 1…256
Filter action	Measurements, analog signal retransmission, serial communication (fundamental variables: V, A, W and their derived ones)
Displaying	
Number of variables	Up to 5 variables per page. See 'Front view'. 7 different set of variables available (see 'Display pages') according to the application being selected. One page is freely programmable as combination of variables
Backlight	The backlight time is programmable from 0 (always on) to 255 minutes
Virtual alarms	
Working condition	Basic unit (indication only) or with (P) optional digital output modules
No. of alarms	Up to 4
Working mode	Up alarm and down alarm

Table 39 - Main Functions

Attribute	Value
Controlled variables	The alarms can be connected to any instantaneous variable. See List of Connectable Variables on page 69
Set-point adjustment	From 0…100% of the display scale
Hysteresis From	0 to full scale
On-time delay	0…9999s
Response time, min	≤ 200 ms, filters excluded. Set-point on-time delay: '0 s'
Reset	By means of the front keypad. It is possible to reset the following data: - all the max and dmd values. - total energy: kWh, kVARh; - partial energy: kWh, kVARh
Clock	
Functions	Universal clock and calendar
Time format	Hour: minutes: seconds with selectable 24 hours or AM/PM format
Date format	Day-month-year with selectable DD-MM-YY or MM-DD-YY format
Battery life	10 years
Easy connection function	For all the display selections, both energy and power measurements are independent from the current direction. The displayed energy is always 'imported'

Table 40 - General Specifications

Attribute	Value
Temperature, operating	-25…55 °C (-13…131 °F) (R.H. from 0…90% noncondensing @ 40 °C) according to EN62053-21, EN50470-1 and EN62053- 23
Temperature, storage	-30…70 °C (-22…158 °F) (R.H. < 90% noncondensing @ 40 °C) according to EN62053-21, EN50470-1 and EN62053- 23
Installation category	Cat. III (IEC60664, EN60664)
Insulation	See Table 42 Isolation Between Inputs and Outputs (1 minute)
Dielectric strength	4 kV AC rms for 1 minute
Noise rejection CMRR	100 dB, 48…62 Hz
EMC	According to EN62052-11
Electrostatic discharge	15 kV air discharge
Immunity to radiated electromagnetic fields	Test with current: 10V/m from 80…2000 MHz
	Test without any current: 30V/m from 80…2000 MHz
Burst	On current and voltage measuring inputs circuit: 4 kV
Immunity to conducted disturbances	10V/m from 150 KHz…80 MHz
Surge	On current and voltage measuring inputs circuit: 4 kV; on 'L' auxiliary power supply input: 1 kV
Radio frequency suppression	According to CISPR 22
Standard compliance	
Safety	IEC60664, IEC61010-1 EN60664, EN61010-1
Metrology	EN62052-11, EN62053-21, EN62053-23, EN50470-3. MID 'annex MI-003'
Pulse output	DIN43864, IEC62053-31
Approvals	CE, cULus (E56639)
Connections	Screw-type
Cable cross-section area	Max 2.5 mm^2 (14 AWG) Screw tightening torque: 0.4 N•m min/0.8 N•m max Suggested screw tightening torque: 0.5 N•m

Table 40 - General Specifications

Attribute	Value
Housing DIN	
Dimensions (WxHxD)	Module holder: 96 x 96 x 50 mm 'A' and 'B' type modules: 89.5 x 63 x 16 mm 'C' type module: 89.5 x 63 x 20 mm
Depth behind panel, max	81.7 mm
Material	ABS, self-extinguishing: UL 94 V-0
Mounting	Panel mounting
Pollution degree	2
Protection degree, front(1)	IP65, UL type 4x indoor (NEMA4x indoor), UL type 12 (NEMA12), for use on flat surface of a Type 4X Indoor enclosure; for use on flat surface of a Type 12 enclosure.
Protection degree, screw terminals	IP20
Weight, approx	400 g (0.88 lb) (packing included)

(1) Use with 60 or 70 °C copper conductor. Maximum surrounding air temperature 40 °C. The device shall be installed in a pollution degree 2 environment. Open Type Device. The terminals L1, L2, and L3 shall be aquired by a circuit where devices or system, including filters or air gaps, are used to control overvoltages at the maximum rated impulse withstand voltage peak of 6.0 kV. Devices or system shall be evaluated using the requirements in the Standard for Transient Voltage Surge Suppressors, UL 1449. Terminals tightening torque 0.79 N•m (7 lb•in). The sum of the internal power consumption of the assembled modules shall not be more than 5.3 W.

Table 41 - Power Supply Specification

Attribute	Value
Auxiliary power supply	90…260V AC/DC (48…62 Hz)
Power consumption	AC: 6 VA; DC: 3.5 W

Table 42 - Isolation Between Inputs and Outputs (1 minute)

	Measuring Inputs	Relay Outputs	Communication Port	Analog Outputs	Auxiliary Power Supply
Measuring Inputs	-	4 kV	4 kV	4 kV	4 kV
Relay outputs	4 kV	2 kV	4 kV	4 kV	4 kV
Communication port	4 kV	4 kV	-	4 kV	4 kV
Analog Outputs	4 kV	4 kV	4 kV	0 kV	4 kV
Aux. power supply	4 kV	4 kV	4 kV	4 kV	-

TIP Current inputs must be connected to external current transformers because the isolation among the current inputs is just functional (100V AC).

List of Connectable Variables

The variables listed in this table can be connected to the following items:

- Analog outputs (all variables except energy values and run hour counter)
- Pulse outputs (only energy values)
- Alarm outputs (except energy, hour counter, and max values)

(X) = available; (O) = not available (variable not available on the display); (#) Not available (the relevant page is not displayed) (1) Max value with data storage

Table 43 - Variables

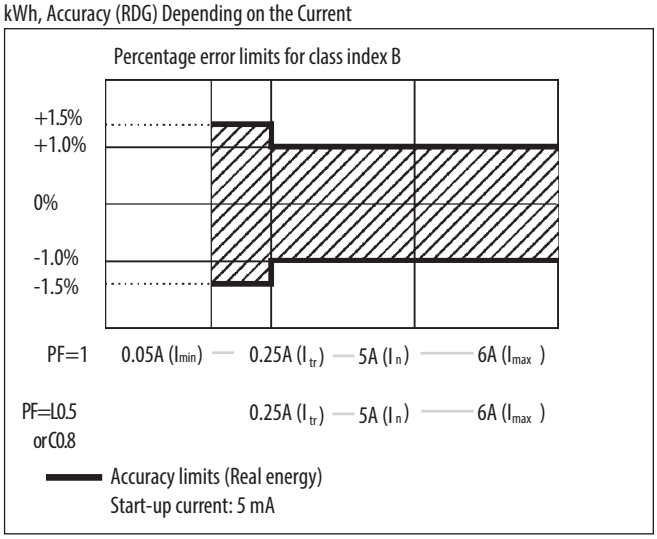
No	Variable	1-ph. Sys	2-ph. Sys	3-ph. 3/4-wire Balanced Sys	3-ph. 2-wire Balanced Sys	3-ph. 3-wire Unbal. Sys	3-ph. 4-wire Unbal. Sys	Notes
1	VL-N sys	O	X	X	X	#	X	sys= system= ∑ (1)
2	VL1	X	X	X	X	#	X	(1)
3	VL2	O	X	X	X	#	X	(1)
4	VL3	O	O	X	X	#	X	(1)
5	VL-L sys	O	X	X	X	X	X	sys= system= ∑(1)
6	VL1-2	#	X	X	X	X	X	(1)
7	VL2-3	#	O	X	X	X	X	(1)
8	VL3-1	#	O	X	X	X	X	(1)
9	AL1	X	X	X	X	X	X	(1)
10	AL2	O	X	X	X	X	X	(1)
11	AL3	O	O	X	X	X	X	(1)
12	VA sys	X	X	X	X	#	X	sys= system= ∑ (1)
13	VA L1	X	X	X	X	#	X	(1)
14	VA L2	O	X	X	X	#	X	(1)
15	VA L3	O	O	X	X	#	X	(1)
16	var sys	X	X	X	X	#	X	sys= system= ∑ (1)
17	var L1	X	X	X	X	#	X	(1)
18	var L2	O	X	X	X	#	X	(1)
19	var L3	O	O	X	X	#	X	(1)
20	W sys	X	X	X	X	X	X	sys= system= ∑ (1)
21	WL1	X	X	X	X	#	X	(1)
22	WL2	O	X	X	X	#	X	(1)
23	WL3	O	O	X	X	#	X	(1)
24	PF sys	X	X	X	X	#	X	sys= system= ∑ (1)
25	PF L1	X	X	X	X	#	X	(1)
26	PF L2	O	X	X	X	#	X	(1)
27	PF L3	O	O	X	X	#	X	(1)
28	Hz	X	X	X	X	X	X	(1)
29	Phase seq.	O	X	X	X	X	X	
30	Asy VLL	O	O	X	X	X	X	Asymmetry (unbalance)
31	AsyVLN	O	O	X	X	O	X	Asymmetry (unbalance)
32	Run Hours	X	X	X	X	X	X	
33	kWh (+)	X	X	X	X	X	X	Total
34	kVARh (+)	X	X	X	X	#	X	Total
35	kWh (+)	X	X	X	X	X	X	Partial

Table 43 - Variables

No	Variable	1-ph. Sys	2-ph. Sys	3-ph. 3/4-wire Balanced Sys	3-ph. 2-wire Balanced Sys	3-ph. 3-wire Unbal. Sys	3-ph. 4-wire Unbal. Sys	Notes
36	kVARh (+)	X	X	X	X	#	X	Partial
37	kWh (-)	X	X	X	X	X	X	Total
38	kVARh (-)	X	X	X	X	#	X	Total
39	kWh (-)	X	X	X	X	X	X	Partial
40	kVARh (-)	X	X	X	X	#	X	Partial

Figure 21 - Accuracy

kWh, Accuracy (RDG) Depending on the Current



kVARh, Accuracy (RDG) Depending on the Current

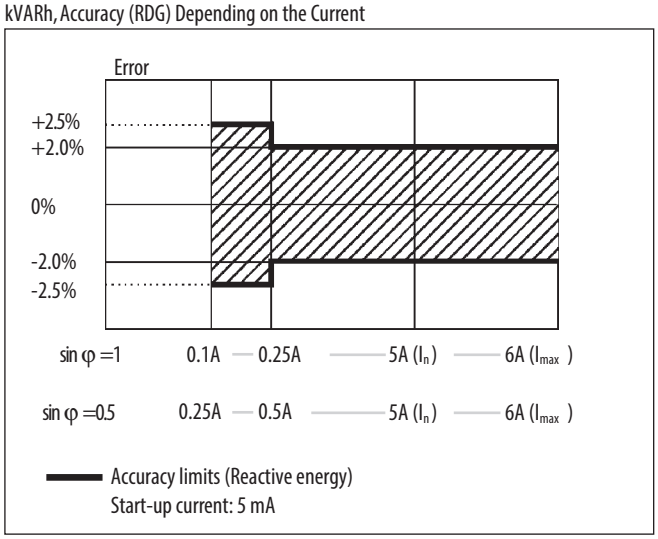


Figure 22 - Calculation Formulas

Phase variables

Instantaneous effective voltage

$$V_{1N} = \sqrt{\frac{1}{n} \cdot \sum_{1}^{n} (V_{1N})_i^2}$$

Instantaneous real power

$$W_1 = \frac{1}{n} \cdot \sum_{1}^{n} (V_{1N})_i \cdot (A_1)_i$$

Instantaneous power factor

$$\cos\varphi_1 = \frac{W_1}{VA_1}$$

Instantaneous effective current

$$A_1 = \sqrt{\frac{1}{n} \cdot \sum_{1}^{n} (A_1)_i^2}$$

Instantaneous apparent power

$$VA_1 = V_{1N} \cdot A_1$$

Instantaneous reactive power

$$\mathrm{var}_1 = \sqrt{(VA_1)^2 - (W_1)^2}$$

System variables

Equivalent three-phase voltage

$$V_\Sigma = \frac{V_1 + V_2 + V_3}{3} \cdot \sqrt{3}$$

V oltage asymmetry

$$ASY_{LL} = \frac{(V_{LL\,max} - V_{LL\,min})}{V_{LL\,\Sigma}}$$

$$ASY_{LN} = \frac{(V_{LN\,max} - V_{LN\,min})}{V_{LN\,\Sigma}}$$

Three-phase reactive power

$$\mathrm{var}_\Sigma = (\mathrm{var}_1 + \mathrm{var}_2 + \mathrm{var}_3)$$

Three-phase real power

$$W_\Sigma = W_1 + W_2 + W_3$$

Three-phase apparent power

$$VA_\Sigma = \sqrt{W_\Sigma^2 + \mathrm{var}_\Sigma^2}$$

Three-phase power factor (TPF)

$$\cos\varphi_\Sigma = \frac{W_\Sigma}{VA_\Sigma}$$

Energy metering

$$k\,\mathrm{var}\,hi = \int_{t1}^{t2} Qi(t)dt \cong \Delta t \sum_{n1}^{n2} Qnj$$

$$kWhi = \int_{t1}^{t2} Pi(t)dt \cong \Delta t \sum_{n1}^{n2} Pnj$$

Where:

i= considered phase (L1, L2 or L3)
P = real power; Q = reactive power;
t_1, t_2 =starting and ending time points of consumption recording; n = time unit; Δ t= time interval between two successive power consumptions;
n_1, n_2 = starting and ending discrete time points of consumption recording

Notes:

PowerMonitor 500 EtherNet/IP Device Profile

This section describes the specific CIP Objects, Instances, Attributes, and Services supported by the PowerMonitor 500 system. This information is for anyone wishing to integrate the PowerMonitor 500 system into existing or planned shop floor networks.

General

For this device profile, we use a PowerMonitor 500 unit and an EtherNet/IP communication module to provide power and energy metering data via an EtherNet/IP network. The data is accessed as instances of the device's Assembly Object.

This profile documents objects that are proprietary, or in some way altered from their generic behavior. Standard CIP objects that are generic in their interface are documented in the EtherNet/IP specification.

Object Model and Interface

The PowerMonitor 500 system is represented by the following Object Model.

Object Class	Instance Numbers	Number of Connections
Identity	1	0
Assembly	100d .. 108d	18

Identity Object

Class Code 01 hex

The Identity Object is used to provide identification information about the device. Each node supports at least one instance of the identity object. The Identity Object is used by applications to determine which nodes are on the network.

See Section 5-2 of the CIP Common Specification for full details of this object.

Class Attributes

Attr ID	Access	Name	Data Type	Default Value
0x01	Get	Revision	UINT	1
0x02	Get	Max Instance	UINT	1
0x03	Get	Number of Instances	UINT	1
0x06	Get	Maximum ID Number Class Attributes	UINT	7
0x07	Get	Maximum ID Number Instance Attributes	UINT	7

Instance Attributes

Attr ID	Access	Name	Data Type
0x01	Get	Vendor ID	UINT
0x02	Get	Device Type	UINT
0x03	Get	Product Code	UINT
0x04	Get	Revision	Struct of:
		Major Revision	USINT
		Minor Revision	USINT
0x05	Get	Status	WORD
0x06	Get	Serial Number	UDINT
0x07	Get	Product Name	SHORT_STRING

Common Services

Service Code	Class/Instance Usage	Service Name
0x01	Class/Instance	Get_Attributes_All
0x05	Instance	Reset
0x0E	Class/Instance	Get_Attribute_Single

Get Attribute All Service

The Get Attribute All service returns a concatenation of all class or instance attributes.

Reset Service

The service accepts the following request parameter.

Request Parameters

Parameter	Data Type	Description
Type	USINT	Type of Reset to perform

Reset Types

The type of Reset requested can be any of the following.

Value	Name	Description
0	Power-Cycle	Emulate as closely as possible cycling power on the item the Identity Object represents.
1	Power-Cycle	Emulate as closely as possible cycling power on the item the Identity Object represents.
2…255	Reserved	Reserved

Behavior

When the Identity Object receives a Reset request, it determines if the reset type is supported, responds to the request, and executes the type of reset requested. The Reset Service 1 restores the factory default settings for ACD.

Get Attribute Single Service

The Get Attribute Single service returns the single attribute specified by the parameter Attribute ID.

Request Parameters

Parameter	Data Type	Description
Attribute ID	UINT	Identifies the attribute to be read/returned

Identity Object Instances

Besides the class instance (instance 0), the communication module's Identity Object supports the following instance.

Instance 1 (PowerMonitor 500 device and communication module)

Instance 1 represents the PowerMonitor 500 device with its EtherNet/IP module. Instance 1 of the Identity Object is the one that is browsed by RSLinx software, relevant to the complete device, that is, the PowerMonitor 500 device and communication module.

Instance 1 of the Identity Object reports the following instance specific attribute values.

Instance 1 Attribute Values

Attr ID	Name	Value
0x01	Vendor ID	1 (Rockwell Automation)
0x02	Device Type	0x92 (146d)
0x03	Product Code	See table below
0x04	Revision	Dynamic (varies with the communication firmware revision)
0x05	Status	Dynamic
0x06	Serial Number	940000000…950000000
0x07	Product Name	PowerMonitor 500

Product Code Values

Part Number	Name	Product Code	Description
1420-V1-ENT	146 - PowerMonitor 500	4	PowerMonitor 500 (240V ac, No I/O) Catalog Number 1420-V1-ENT
1420-V1P-ENT	146 - PowerMonitor 500	5	PowerMonitor 500 (240V ac, Digital I/O) Catalog Number 1420-V1P-ENT
1420-V1A-ENT	146 - PowerMonitor 500	6	PowerMonitor 500 (240V ac, Analog I/O) Catalog Number 1420-V1A-ENT
1420-V2-ENT	146 - PowerMonitor 500	7	PowerMonitor 500 (690V ac, No I/O) Catalog Number 1420-V2-ENT
1420-V2P-ENT	146 - PowerMonitor 500	8	PowerMonitor 500 (690V ac, Digital I/O) Catalog Number 1420-V2P-ENT
1420-V2A-ENT	146 - PowerMonitor 500	9	PowerMonitor 500 (690V ac, Analog I/O) Catalog Number 1420-V2A-ENT

Assembly Object

Class Code: 04 hex

The assembly object collects attributes from multiple objects, allowing data to or from each object to be sent or received over a single connection. Assembly objects are used to produce and/or consume data to/from the network. An instance of the assembly object can both produce and consume data from the network.

Static assemblies are factory determined and cannot be modified by the user of the product. Members cannot be added or deleted. The implementation of the Assembly object shall be static. See Section 5-5 of the CIP Common Specification for full details of this object.

Class Attributes

Attr ID	Access	Name	Data Type	Default Value
0x01	Get	Revision	UINT	2
0x02	Get	Max Instance	UINT	108d
0x03	Get	Number of Instances	UINT	9
0x04	Get	Optional Attributes List	STRUCT of UINT ARRAY of UINT	0x0001, {0x0004}
0x06	Get	Maximum ID Number Class Attributes	UINT	7
0x07	Get	Maximum ID Number Instance Attributes	UINT	4

Instance Attributes

Attr ID	Access	Name	Data Type	Default Value
0x03	Get	Data	Instance Dependent (1)	All of the member data packed into one array.
0x04	Get	Size	Size (in bytes) of the Data attribute	Instance Dependent(1)

(1) See Chapter 4 for more information.

Common Services

Service Code	Class/Instance Usage	Service Name
0x0E	Class/Instance	Get Attribute Single

Get Attribute Single Service

The Get Attribute Single service returns the single attribute specified by the parameter Attribute ID.

Request Parameters

Parameter	Data Type	Description
Attribute ID	UINT	Identifies the attribute to be read / returned

Assembly Object Instances

The communication module's Assembly Object supports nine instances (instances 100d to 108d). The Data attributes of these instances can be accessed via Class 1 scheduled connections and via Class 3 or UCMM unscheduled connections.

The tables in Chapter 4 define the size and content of the Data attribute for each Assembly object instance.

Connections

The Assembly Object supports both scheduled (Class 1) and unscheduled connections (Class 3 and UCMM). Both connections are used to access instances 100d to 108d of the Assembly Object:

- UDP - Nine Class 1 connections each to the nine assembly instances 100 to 108 at 100 ms RPI ran stable
- TCP - Nine Class 3 connections each to the nine assembly instances 100 to 108 at 200 ms RPI ran stable
- Both - UDP and TCP can run at the same time

Heartbeat Instances

In addition to the Assembly instances shown earlier, the communication module also recognizes two heartbeat instances. A heartbeat instance is a virtual output instance that can be specified by devices wishing to establish Input Only and Listen Only Class 1 I/O connections to the communication module. Data cannot be read from or written to a heartbeat instance. The heartbeat instance is merely a programming construct that serves to keep the connection active.

The communication modules's heartbeat instances are Instance 98 for the Input Only connection and Instance 99 for the Listen Only connection.

Behavior

The purpose of the Assembly Object is to act as a network interface to the PowerMonitor 500 unit’s data. That data can be accessed by a variety of means: Class 1 or Class 3 connections and also with UCMM messages.

Technical Notes

This section lists additional technical information about Ethernet network communication.

Parameters

For the EtherNet/IP communication module, set the following parameters by using Programming mode through the base module front panel:

- IP address
- Subnet
- Gateway
- Modbus TCP port
- Address Conflict Detect (ACD)

Modbus TCP

The communication module supports Modbus TCP. The protocol is the same as the PowerMonitor 500 unit with RS485 (Modbus RTU). Refer to Chapter 4 for protocol details. In this product, only one Modbus TCP connection (1 socket) is allowed.

The EtherNet/IP and Modbus TCP do not run concurrently. If Modbus TCP communication occurs, EtherNet/IP communication stops temporarily but recovers in a minute or two.

ACD

If an address conflict is detected from the communication module, then the base module displays 'ACD Found'. In that case, it is necessary to check the network configuration, resolve the problem, and then cycle control power to the power monitor to re-establish communication.

TCP/IP Port

Default EtherNet/IP ports include the following:

- UDP (implicit message): 2222 (0x08AE)
- TCP (explicit message): 44818 (0xAF12)

You can reassign the default Modbus TCP port:502 (0x01F6).

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In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/services/online-phone.

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If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

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